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Resolution of the *Thelymitra fuscolutea* R. Br. (Orchidaceae) complex of southern Australia.

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Abstract

The seven currently known taxa in the *Thelymitra fuscolutea* R.Br. complex from southern Australia are discussed and descriptions are presented for each. *Thelymitra jacksonii* Hopper & A.P.Br. ex Jeanes, *Thelymitra magnifica* Jeanes and *Thelymitra yorkensis* Jeanes from southwestern Western Australia are described as new and illustrated. The key diagnostic features relating to the size and colour of the perianth and the shape of the supra-anther lobe of the column are elucidated. Information on distribution, habitat, pollination biology, flowering time and conservation status is given for all seven taxa. The main distinguishing features of *Thelymitra benthamiana* Rehb.f., *Thelymitra dedmaniarum* R.S.Rogers, *T. fuscolutea* and *Thelymitra stellata* Lindl. and the three new species are tabulated. A key is provided to distinguish all seven members of the *T. fuscolutea* complex.

Introduction

Thelymitra J.R.Forst. & G.Forst. is a complex genus of orchids consisting of about 90 described species, several described natural hybrids and at least 20 undescribed taxa. It is concentrated in higher rainfall areas of temperate Australia, but a few species occur in tropical northeastern Australia, about 20 species occur in New Zealand (15 endemic) and a few species occur in Indonesia, New Caledonia, New Guinea and the Philippines.

A number of morphological features exist that, in combination, distinguish members of the *Thelymitra fuscolutea* R.Br. complex from other *Thelymitra* species. The column has a well developed wing with a fimbriate distal margin and a pair of digitate lateral lobes (each with a pair of similar but thinner and often longer basal lobes) inserted on the column wing between the fimbriae and the post-anther lobe. The post-anther lobe (sometimes called the mid-lobe) is continuous with the column wing, more or less rectangular and is covered on the dorsal surface by short, bristly trichomes, varying in density between species. Decurrent on the dorsal surface of the column is a fleshy, rod-like, often clavate supra-anther lobe, situated mostly above the post-anther lobe. The anther has an elongate terminal beak that is essentially an extension of the connective (see Fig. 1). The leaves are glabrous, generally entirely pale green, ovate to ovate-lanceolate and held close to the ground or sub-erect (only *Thelymitra crinita* from Western Australia has similarly shaped leaves, but these can be distinguished readily by the maroon stripes and suffusions near the base). The perianth is generally bicoloured, usually spotted, blotched or striated in various shades of yellow and brown.

Taxonomic history

The first species in the group recognised, *T. fuscolutea*, was described by Brown (1810), the distribution given as (M.) for southern Australia between Cape Leeuwin and

Wilsons Promontory. The lectotype (*vide* Clements 1989) is from King George Sound (Albany district) Western Australia. Lindley (1839–1840) described *Thelymitra stellata* Lindl., the distribution given as Western Australia (Lindley 1840). Reichenbach (1871) described *Thelymitra benthamiana* Rchb.f., the distribution given as Swan River. In *Flora Australiensis*, Bentham (1873) recognised only *T. fuscolutea* and *T. stellata*, while reducing *T. benthamiana* to synonymy under the former. Rogers (1938) described *Thelymitra dedmaniarum* R.S.Rogers (as *Thelymitra Dedmanae*) from Toodyay near Perth in southwestern Western Australia. There had long been confusion about the delimitations of the above four taxa, and George (1971) created the new combinations *T. fuscolutea* R.Br. var. *fuscolutea* (with *T. benthamiana* reduced to synonymy therein) and *T. fuscolutea* R.Br. var. *stellata* (Lindl.) A.S.George (with *T. stellata* reduced to varietal rank and *T. dedmaniarum* [as *T. dedmaniae*] reduced to synonymy therein). This classification was taken up by Hoffman and Brown (1984). Following his study of Australian Orchidaceae types, Clements (1989) again recognised *T. benthamiana*, *T. fuscolutea* and *T. stellata* as distinct species while relegating *T. dedmaniarum* (as *T. dedmaniae*) to synonymy under *T. stellata*. Hoffman and Brown (1992) followed Clements in recognising *T. benthamiana*, *T. fuscolutea* and *T. stellata* as distinct species, but also reinstated *T. dedmaniarum* (as *T. dedmaniae*) as a species following its recent rediscovery. Hoffman and Brown (1992) also informally described *Thelymitra jacksonii* ms (formally described below as *T. jacksonii* Hopper & A.P.Br. ex Jeanes), a newly discovered species from the Walpole area west of Albany. Hoffman and Brown (1998) again recognised *T. benthamiana*, *T. fuscolutea*, *T. stellata*, *T. dedmaniarum* (this time with the name incorrectly applied to specimens found in 1996 during surveys southwest of York, described below as *Thelymitra yorkensis* Jeanes) and *T. jacksonii* ms, while recognising *Thelymitra* aff. *dedmaniarum* (the true *T. dedmaniarum*, and later to become incorrectly known informally as *Thelymitra manginii* ms and subsequently *Thelymitra manginiorum* ms). In addition, Hoffman & Brown (1998) recognised a further taxon designated as *Thelymitra* aff. *stellata* (described below as *Thelymitra magnifica* Jeanes). This brought the total number of species in the group to seven, three of which remained undescribed. For a summary of the taxonomic history see Table 1.

Discussion

Historically there has been great confusion about the correct application of names and the interpretation of species within the *T. fuscolutea* complex. At least some of this confusion has persisted to the present day and has revealed itself in the many floras and orchid books published over the years.

The type material of Brown's *T. fuscolutea* was collected by Bauer at King George Sound (Albany district) Western Australia in January 1802 and is currently housed at the British Museum, London along with two excellent drawings executed by Bauer in December 1801. The type material and the Bauer drawings fix the name of *T. fuscolutea* unequivocally, the most salient feature being the digitiform supra-anther lobe on the column. Although the apex of the supra-anther lobe is depicted as bilobed in Bauer's front view of the column, there is no evidence that it is clavate to any significant degree. In 1839 Drummond collected the type material of Lindley's *T. stellata*, probably somewhere between Perth and his property at Toodyay some 80 km to the northeast. The illustration of the column on the holotype sheet (probably executed by Lindley) shows the supra-anther lobe to have a markedly clavate and warty apex, thus clearly distinguishing *T. stellata* from *T. fuscolutea*. Reichenbach (1871) described *T. benthamiana*, also from material collected by Drummond (in 1838), and carefully

compared his new species to *T. fuscolutea* and *T. stellata*, particularly in terms of the differences in the supra-anther lobe (termed the ‘dorso androclinii’ by Reichenbach). Bentham (1873) argued that *T. benthamiana* was synonymous with *T. fuscolutea* based largely on his interpretation of Bauer’s drawings and a specimen collected by Captain King that appears to conform to *T. benthamiana* but was labelled by Brown as *T. fuscolutea*. Bentham’s interpretation of Bauer’s drawings is difficult to follow and, I believe, unconvincing. Since both *T. fuscolutea* and *T. benthamiana* occur in the Albany district (and the latter is generally the more common) it would not be surprising if the King collection were the latter species; nor would it be surprising if Brown wrongly interpreted it as his own *T. fuscolutea* given his limited exposure to the group during his brief visit. Reichenbach (1874) quickly repudiated Bentham’s arguments and published a drawing of *T. fuscolutea* and *T. benthamiana* side by side, which shows clearly the different structure of the supra-anther lobe of the two species.

Nearly all the authors of significant floras and orchid accounts since Bentham (1873) and prior to Jones (1988) unfortunately adopted Bentham’s taxonomy over Reichenbach’s (e.g. Mueller 1882, Rogers 1911, Black 1922, Ewart 1931, Erickson 1951, Blackall 1954, Willis 1962, Gray 1966, Nicholls 1969 & Fiveash & Lothian 1974). George (1971) further simplified matters by reducing *T. stellata* to varietal status under *T. fuscolutea* and Hoffman & Brown (1984) followed this approach. Following his study of orchid type material, illustrations and the literature, Clements (1989) came to the conclusion that *T. benthamiana*, *T. fuscolutea* and *T. stellata* were distinct entities worthy of recognition at species rank. This view is supported by the results of contemporary research and field studies, including my own work, and most recent authors have followed Clements’ taxonomy (e.g. Bates & Weber 1990, Hoffman & Brown 1992, Weber & Entwistle 1994, Backhouse & Jeanes 1995, Hoffman & Brown 1998, Jeanes & Backhouse 2004).

Rogers (1938) described *T. dedmaniarum* from specimens collected in 1934 by Mrs and Miss Dedman at Toodyay, Western Australia. The specific epithet given by Rogers was *Dedmanae*, but this was corrected recently to *dedmaniarum* to conform to Article 60.11 of the International Code of Botanical Nomenclature. The termination must be in the feminine plural, because the epithet commemorates Mrs and Miss Dedman, hence ‘-iarum’. The new species was described by Rogers as being ‘rather robust’ and to have ‘unspotted perianth-segments’, two features clearly seen in the type specimens housed at AD. Rogers compared *T. dedmaniarum* with *T. fuscolutea*, but the strongly clavate supra-anther lobe and large flowers would suggest that it has closer affinities with *T. stellata*. Erickson (1951) and Blackall (1954) accepted *T. dedmaniarum* as a distinct species, but George (1971) reduced it to synonymy under his *T. fuscolutea* var. *stellata*. His argument was that it ‘only differs from the var. *fuscolutea* (sic) [presumably a typographical error that should read var. *stellata*] in having the perianth more uniformly golden-brown and the column fringe a bright orange’. Since *T. dedmaniarum* was known only from the type specimens, and had not been seen for nearly 40 years, George’s opinion about it being a mere colour form was generally followed (e.g. Hoffman & Brown 1984 & Clements 1989). In 1985 *T. dedmaniarum* was rediscovered near Gidgegannup, about 35 km northeast of Perth, and the consistency of these plants and their similarity to the type and Rogers’ original description were convincing evidence that it was a valid species worthy of recognition (see Hoffman & Brown 1992, page 243). The identity of *T. dedmaniarum* became confused when Hoffman & Brown (1998) incorrectly linked the name to plants found in 1995 in the vicinity of York (about 90 km east of Perth). These plants in fact represented an undescribed species, described

Table 1. Taxonomic history of the *T. fuscolutea* complex and the names used by various authors

Author	Name used	Name used	Name used	Name used	Name used	Name used	Name used
Brown (1810)	<i>T. fusco-lutea</i>	n/a	n/a	n/a	n/a	n/a	n/a
Lindley (1839–1840)	<i>T. fusco-lutea</i>	n/a	n/a	n/a	n/a	n/a	n/a
Lindley (1840)	<i>T. fusco-lutea</i>	<i>T. stellata</i>	n/a	n/a	n/a	n/a	n/a
Reichenbach (1871)	<i>T. fusco-lutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	n/a	n/a	n/a	n/a
Bentham (1873)	<i>T. fusco-lutea</i>	<i>T. stellata</i>	<i>T. fusco-lutea</i>	n/a	n/a	n/a	n/a
Reichenbach (1874)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	n/a	n/a	n/a	n/a
Mueller (1882)	<i>T. fusco-lutea</i>	<i>T. stellata</i>	none	n/a	n/a	n/a	n/a
Rogers (1938)	<i>T. fuscolutea</i>	none	none	<i>T. Dednatae</i>	n/a	n/a	n/a
Erickson (1951)	<i>T. fuscolutea</i>	<i>T. stellata</i>	none	<i>T. Dednatae</i>	n/a	n/a	n/a
Blackall (1954)	<i>T. fusco-lutea</i>	<i>T. stellata</i>	none	<i>T. Dednatae</i>	n/a	n/a	n/a
Nicholls (1969)	<i>T. fusco-lutea</i>	none	none	none	n/a	n/a	n/a
George (1971)	<i>T. fuscolutea</i> var. <i>fuscolutea</i>	<i>T. fuscolutea</i> var. <i>stellata</i>	<i>T. fuscolutea</i> var. <i>stellata</i>	<i>T. fuscolutea</i> var. <i>stellata</i>	n/a	n/a	n/a
Fivesh & Lothian (1974)	<i>T. fusco-lutea</i>	none	none	none	n/a	n/a	n/a
Hoffman & Brown (1984)	<i>T. fuscolutea</i> var. <i>fuscolutea</i>	<i>T. fuscolutea</i> var. <i>stellata</i>	none	none	n/a	n/a	n/a
Jones (1988)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	none	n/a	n/a	n/a
Clements (1989)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	<i>T. stellata</i>	n/a	n/a	n/a
Hoffman & Brown (1992)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	<i>T. dednatae</i>	<i>T. jacksonii</i>	n/a	n/a
Hoffman & Brown (1998)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	<i>T. aff. dednatarum</i>	<i>T. jacksonii</i>	<i>T. aff. stellata</i>	<i>T. dednatarum</i>
Jeanes (this paper)	<i>T. fuscolutea</i>	<i>T. stellata</i>	<i>T. benthamiana</i>	<i>T. dednatarum</i>	<i>T. jacksonii</i>	<i>T. magnifica</i>	<i>T. yorkensis</i>

Table 2. Various features of species in the *T. fuscolutea* complex.

Feature	<i>T. fuscolutea</i>	<i>T. benthamiana</i>	<i>T. jacksonii</i>	<i>T. magnifica</i>	<i>T. ledmianianum</i>	<i>T. yorkensis</i>	<i>T. stellata</i>
Sepal length	8–20 mm	10–20 mm	16–27 mm	16–28 mm	12–28 mm	13–26 mm	12–22 mm
Perianth colour	Mostly brown or purplish with few yellow or greenish spots or striations	Yellow or greenish with reddish brown spots and blotches	Dark golden-brown with large yellow blotches and striations	Dark golden-brown with large yellow blotches and striations	Mostly golden yellow, often reddish brown towards the base	Orange with reddish brown edges	Brown to reddish brown with large yellow blotches and striations
Column apex colour	White or cream	Yellow or orange	Yellow or orange	Yellow or orange	Yellow or orange	Yellow or orange	Yellow or orange
Supra-anther lobe shape	Digitiform	Slightly clavate	Markedly clavate	Markedly clavate	Markedly clavate	Markedly clavate	Markedly clavate
Supra-anther lobe apex	Smooth, undifferentiated	Rugose	Rugose to warty, bilobed, ridged	Rugose to warty, ridged	Rugose, bilobed	Rugose to warty	Rugose to warty, bilobed, ridged
Anther beak size	2–3 × c. 1 mm	2.5–3.5 × c. 0.8 mm	3–4 × c. 1.5 mm	2.5–3 × c. 1.4 mm	2.5–3.5 × c. 2 mm	2.5–3 × c. 1.5 mm	2–3 × c. 1.2 mm
Floral scent	None noted	None noted	Sweet	Cinnamon-like	Cinnamon-like	Cinnamon-like	Sweet
Flowering time	Nov. –Feb.	Sept. –Nov.	Dec. & Jan.	Sept. & Oct.	Oct. & Nov.	Oct. –Dec.	Oct. & Nov.
Preferred substrates	Moist sandy loams	Dry or seasonally moist sandy loams	Moist sandy clay soils	Seasonally moist granitic soils	Dry granitic soils	Dry granitic soils	Dry lateritic soils

in this paper as *T. yorkensis*. As a critically endangered species *T. dedmaniarum* has been subject to a draft recovery plan (Phillimore et al. 1999), but unfortunately this has been done under the superfluous name *T. manginii* ms (later amended to the equally superfluous *T. manginiorum* ms).

Recent fieldwork in Western Australia has revealed three rare cryptic undescribed species with close affinities to *T. stellata* (see Hoffman & Brown 1992 & Hoffman & Brown 1998). My own research has confirmed the presence of these species and the main purpose of this paper is to describe them and to clarify how they differ from other members of the *T. fuscolutea* complex, and in particular from *T. stellata*. They are so similar morphologically to *T. stellata* that it creates the problem of fixing that name correctly to a particular species, as known today. Pressed material of members of the genus *Thelymitra* can be very difficult to identify positively as many diagnostic features are lost or become difficult to interpret upon drying and pressing. This is certainly true of the type specimens of *T. stellata*, and this situation is not helped by the complete absence of accurate location information or any biological or ecological data on the type sheets. All we have is pressed material and a rough sketch of the column on the holotype, but these could equally fit any of the four species in the group (as well as *T. dedmaniarum*). Traditionally the name *T. stellata* has been linked to the most widespread member of the group, found on lateritic soils mainly between Three Springs and Pinjarra, but which is also known to have occurred at least in the vicinity of the type locality (see Hoffman & Brown 1992, page 244). With the lack of any compelling evidence to the contrary it would appear prudent to continue to link the name *T. stellata* with this species. For a comparison between the various characteristics of *T. stellata* and the three new species, *T. jacksonii*, *T. magnifica* and *T. yorkensis*, see Table 2 and the individual species accounts.

Sub-generic classifications

Surprisingly, the *T. fuscolutea* complex has never had any formal recognition at the subgeneric level in spite of the many distinctive and unique characters of the group. Brown (1810) recognised two informal groups within *Thelymitra*, group one with blue, white or pink flowers and group two with yellow flowers. Brown placed *fuscolutea*, along with *helymitra tigrina* R.Br., into his group two. Bentham (1873) included *T. fuscolutea* and *T. stellata* (the only two species within the *T. fuscolutea* complex then recognised) within his section *Cucullaria*, along with a diverse assemblage of species sharing in common a hooded post-anther lobe over the anther.

Although there are several obvious groups within *Thelymitra* that would lend the genus to a subgeneric classification, such a classification would be premature without a comprehensive molecular phylogenetic study of the genus as a whole. Such a study would also help to place the several apparently anomalous species within a subgeneric framework.

Explanation of the terminology used

The genus *Thelymitra* is unusual in the Orchidaceae in that the six perianth segments generally differ very little from each other in terms of size, shape and ornamentation. The labellum does not bear any hairs, calli, glands, ridges, lobes, teeth or fringes and is apparently not involved in pollination. Since the perianth is virtually actinomorphic and generally lacks characters by which to distinguish the species, traditionally the structure of the column has supplied most of these distinguishing characters. Over the years a

terminology has evolved to describe the column structure in *Thelymitra*, but some of these terms are poorly understood and some have never been defined adequately. Below is an explanation of some of the terms commonly used in this paper; most have a traditional usage, although this has often not been well understood, while one is used for the first time.

Column (gynostemium): The column is exposed in the centre of the flower, it lacks a free filament and style, is short and thick and broadly winged from below the stigma to the level of the anther or beyond. The apex is usually 3–5-lobed and is often ornamented with trichomes, fringes, teeth, calli, glands, tubercles or lobes. In members of the *T. fuscolutea* complex the apex of the column is very distinctive including fimbriae on the distal margins of the column wings, a pair of digitate lateral lobes, each with a pair of thinner, often longer, digitate basal lobes, a post-anther lobe that is continuous with the column wing and has the dorsal surface covered with short, stiff trichomes, and a rod-like, often clavate supra-anther lobe.

Post-anther lobe (mid-lobe): This structure lies beyond the point of insertion of the anther and of the lateral lobes, and it is usually of a different colour to the rest of the column. It has a complex vascular supply always associated with that of the functional anther and may be regarded as an outgrowth of the filament. In some species it is represented only by a short flap or a band of small calli crowded across the back of the anther. In most species it extends well beyond the anther with a free margin that may be plain, undulate, toothed, notched or variously ornamented with tubercles. At its maximum development it forms a fleshy, tubular hood that is variously open on the ventral side and overhangs and obscures the anther. In the *T. fuscolutea* complex the post-anther lobe is continuous with the column wing, fleshy, and covered by short, stiff trichomes on its dorsal surface.

Lateral lobes (column-arms or lateral staminodes): These two structures lie one on each side of the post-anther lobe and extend forward or upward and often converge. They are each supplied by a single unbranched vascular bundle and are thought to represent staminodes. They may be flat and ribbon-like, terete and finger-like, straight, curved, twisted spirally or bent sharply, and are usually ornamented with lobes, teeth, tubercles or trichomes. The lateral lobes are finger-like in members of the *T. fuscolutea* complex, are more or less straight and parallel and point in the same general direction as the body of the column. At the base of each lateral lobe there is a pair of longer, thinner, finger-like lobes.

Auxiliary lobes (accessory lobes or side lobules): Several species of *Thelymitra* have a pair of distinct lobes between the post-anther lobe and the lateral lobes. These have no vascular strand and are most accurately described as being part of a tripartite post-anther lobe. They tend to be fleshy with irregularly jagged margins and sometimes have small surface tubercles. In the *T. fuscolutea* complex the auxiliary lobes are completely absent.

Supra-anther lobe: This is a fleshy, rod-like, often clavate organ that is decurrent on the dorsal surface of the column and is situated mostly above the anther and the post-anther lobe. It does not have its own vascular supply and is best thought of as an appendage of the column. This organ is peculiar to the *T. fuscolutea* complex and in the literature has generally been misinterpreted as the post-anther lobe.

Anther: In *Thelymitra*, the anther is usually small, ovoid, and situated entirely between the column wings. The connective extends beyond the pollinia into an apical beak-like projection of varying size. The anther may be entirely above the stigma or

variously obscured behind it. In the *T. fuscolutea* complex the anther is usually inserted in the lower third of the column, the pollinia partially obscured behind the stigma. The anther beak is very well developed, usually being about as long as the pollinia, is fleshy and shallowly s-shaped in profile.

Pollinia: Members of the genus *Thelymitra* contain four pollinia in two groups of two. In the *T. fuscolutea* complex the pollinia are usually tightly bound with the pollinarium being removed by insects as a single unit. However, autogamy has been noted in *T. benthamiana*.

Stigma: The stigma in *Thelymitra* is more or less bi-lobed at the apex, usually quadrate or transverse-elliptic in shape and located at the base of the column on a thick stalk.

Materials and methods

This paper is the result of a qualitative and quantitative study of the pertinent type material (or photographic reproductions thereof), hundreds of herbarium specimens (both dry and spirit-preserved) from AD, BM, BRI, CANB, E, HO, MEL, NSW, P, PERTH, QRS, SUNIV and WELT, and numerous freshly collected specimens, all of which were vouchered and deposited at the relevant herbaria. Orchid taxa in general, and *Thelymitra* taxa in particular, are much more readily identified from fresh living material where characters of the perianth, the column, flower colour and fragrance are still intact. Familiarity with the taxa gained from field study and the study of freshly collected specimens sent to me by field operatives has made the identification of dried and spirit-preserved herbarium material (including type specimens) much easier.

When collecting *Thelymitra* for study it is essential that the entire above ground parts of the plant be taken, with the majority of the material being preserved in spirit. Plants preserved in the pressed state are often difficult to identify to species level in the absence of additional information. Spirit preserved specimens on the other hand, are generally much more easily identified to species level. The observation of plants growing *in-situ* is the ideal method of study for *Thelymitra* in general, and often it is only by this method that cryptic new species can be identified. For this reason the importance of field work in the study of species complexes within *Thelymitra* cannot be overstated and should form an integral part of any future studies of the group. It is possible that other taxa worthy of recognition exist within this complex, but adequate information and collections of these are lacking at present.

Taxonomy

Key to the known members of the *T. fuscolutea* complex.

1. Perianth segments mostly <20 mm long; supra-anther lobe of column of more or less uniform cross-section throughout or only slightly clavate at the apex 2
1. Perianth segments usually >20 mm long on at least some flowers; supra-anther lobe of column markedly clavate at the apex 3
2. Supra-anther lobe of column digitiform, of more or less uniform cross-section throughout; column apex white or cream; inner surface of perianth predominantly dark reddish brown with narrow greenish yellow margins and a few greenish yellow

- spots and suffusions; flowers November to January; swampy habitats of southwestern Western Australia 1. *T. fuscolutea*
2. Supra-anther lobe of column slightly clavate at the apex; column apex yellowish; inner surface of perianth greenish yellow with dark reddish brown spots and suffusions; flowers September to November; drier habitats of southwestern and southeastern Australia 2. *T. benthamiana*
3. Inner surface of tepals more or less concolorous, of a golden yellow colour, often slightly brownish towards the base; flowers strongly cinnamon-scented..... 5. *T. dedmaniarum*
3. Inner surface of tepals usually strongly bicolorous, mostly brown with golden yellow streaks and blotches; flowers sweet-scented or cinnamon-scented..... 4
4. Supra-anther lobe of column with a prominently clavate, warty apex >1.5 mm thick..... 5
4. Supra-anther lobe of column with a clavate, rugose to warty apex <1.5 mm thick.... 6
5. Supra-anther lobe of column prominently bilobed at apex; plants growing in sandy soils near winter-wet depressions; flowers sweet-scented, appearing December and January; Walpole area 3. *T. jacksonii*
5. Supra-anther lobe of column not prominently bilobed at apex; plants growing in seasonally moist granitic soils on edges of escarpments; flowers cinnamon-scented, appearing September and October; Darling Ranges..... 4. *T. magnifica*
6. Flowers in a moderately open inflorescence, strongly cinnamon scented; supra-anther lobe not prominently bilobed; plants primarily of Wandoo (*Eucalyptus wandoo* and *Eucalyptus accedens*) forests 6. *T. yorakensis*
6. Flowers rather crowded and overlapping, sweet-scented; supra-anther lobe prominently bilobed; plants primarily of Jarrah (*Eucalyptus marginata*) forests 7. *T. stellata*

1. *Thelymitra fuscolutea* R.Br., *Prodr.* 315 (1810).

Type: King George's Sound, 2.i.1802, *F. Bauer s.n.* (lectotype element α BM!, *vide* Clements 1989; isolectotype BM!; iconotype BM!).

Illustrations: Bauer 171A and Bauer 171B (Dec. 1801) both original illustrations at the British Museum; Reichenbach (1874) plate 1991, figs 1–5; Jones (1988) page 295; Hoffman & Brown (1992) page 241; Hoffman & Brown (1998) page 241.

Glabrous terrestrial *herb*. *Tubers* ovoid or obovoid, 1–3 cm long, 5–12 mm wide, fleshy. *Leaf* ovate-lanceolate to ovate, 5–15 cm long, 5–20 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex acute to acuminate, sometimes shortly apiculate. *Scape* 15–45 cm tall, 1.3–3.5 mm diam., more or less straight, green. *Sterile bracts* usually 2, occasionally 3, lanceolate to ovate-lanceolate, 2–7 cm long, 3–10 mm wide, closely sheathing, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 7–32 mm long, 2–6 mm wide, sheathing the pedicels,

green or purplish. *Pedicels* 5–15 mm long, slender. *Ovary* narrow-obovoid, 5–15 mm long, 1.5–4 mm wide, often curved. *Flowers* 2–15(–25), 20–40 mm across, thick-textured, mostly brown or purplish with yellow or greenish spots or stripes, opening freely in warm weather. *Perianth segments* 8–20 mm long, 3–6 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate-lanceolate to lanceolate; *lateral sepals* ovate-lanceolate to lanceolate, often asymmetric; *petals* ovate-lanceolate to lanceolate, often asymmetric; *labellum* ovate-lanceolate to lanceolate, often slightly smaller than other segments. *Column* erect from the end of ovary, 6–9 mm long, 4–6 mm wide, yellow or greenish at base (with or without brownish blotches), cream or whitish towards apex, broadly winged, wings deeply dentate along distal margins, teeth 0.3–2 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of whitish trichomes (each c. 0.5 mm long); *supra-anther lobe* 2–3.5 mm long, 0.7–1 mm wide, 0.7–1.1 mm thick, digitiform, mostly cream or whitish, apex obtuse, emarginate or toothed, ventral side papillose at base; *auxiliary lobes* absent; *lateral lobes* digitiform, 1.5–2 mm long, c. 0.3 mm thick, fleshy, cream or whitish, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid to obloid, 4.5–5.5 mm long, 1.8–2.3 mm wide, connective produced into a fleshy, curved beak 2–3 mm long, c. 1 mm thick, shallowly s-shaped in profile, extending almost to tip of column; *pollinarium* 2–3 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* white, coherent. *Stigma* situated at base of column, ovate-quadrate, 2–3 mm long, 2–3 mm wide, margins irregular. *Capsules* obovoid, 9–20 mm long, 4–7 mm wide, erect, ribbed. (Fig. 2)

Selected specimens examined: WESTERN AUSTRALIA: Summit of Mt Belches (granite) on Duke of Orleans Bay, c. 42 miles east of Esperance, 30.xi.1950, *J.H. Willis s.n.* (MEL 1550456); Geograph Bay, *Miss Bunbury s.n.* (MEL 1550486); Near King George Sound, 1883, *W. Webb s.n.* (MEL 1550482); Denmark-Mt Barker Rd opposite Blue Lakes Rd junction, 14.xii.1984, *A.P. Brown & S. Van Leeuwen 181* (PERTH 269034); Yanchep Park, 16.xii.1953, *R.D. Royce 4756* (PERTH 268054); From Wancaroo-Mullaloo, 25.xi.1962, *E. Wittmer 84* (PERTH 272906); W side of Angove Road, approximately 400 m from Highway 1, 5.i.1997, *W. Jackson BJ449* (PERTH 4665252); Joondalup Drive, c. 3–4 km N of Ocean Reef Rd, Woodvale, 4.xi.1985, *A.P. Brown 268* (PERTH 907014); Yanchep National Park: On S side of beach and just E of park turnoff, 18.xi.1963, *A.M. James 131* (PERTH 268097); Walpole-Nornalup National Park, 28-mile Road, c. 200 m S of northern boundary of park, 28.i.1993, *J.R. Wheeler 3842 & S.J. Palmik* (PERTH 4343115); El Almain Rd, along Donnelly River, SW of Pemberton, 1.ii.1971, *G.J. Keighery 2022* (PERTH 267643); Cult. ex Toondalup, 28.xi.1991, *D.L. Jones 8593* (CANB 9803983); Darling district: Yalgorup Sawmill site, c. 55 km S of Mandurah on Old Coast Road, 12.xii.1993, *C. French DLJ12738* (CANB 9407994).

Distribution and habitat: Endemic to southwestern Western Australia, from just north of Perth to just east of Albany. Records from Mt Belches and Cape Arid east of Esperance (A. Brown, pers. comm.) represent an extreme disjunction. Grows in cool, moist forests, often around the edges of winter-wet swamps, but also in adjacent drier areas. Altitude: 5–200 m.

Conservation status: Uncommon, but moderately widespread and well conserved.

Flowering period: November to February.

Pollination biology: The large, freely opening flowers and only occasional capsule production would suggest that this species is probably entomophilous.

Notes: *Thelymitra fuscolutea* R.Br. is a late flowering member of the *T. fuscolutea* complex mostly from moist habitats, but also from deep sand and well drained laterite soils. See Table 2 for other distinguishing features.

2. *Thelymitra benthami* Rchb.f., *Beitr. Syst. Pflanzenk.* 55 (1871).

Type: Swan River, *J. Drummond* 825 (lectotype W, *fide* George 1971; isoelectotypes G, W, K); *Syntypes:* Swan River, *J. Drummond* 145 (K, W); *?Syntype:* Swan River, 1.x.1838, *J. Drummond* s.n. (BM!).

Illustrations: Reichenbach (1874) plate 19911, figs 6-8; Nicholls (1969) plate 38 (as *T. fuscolutea*); Hoffman & Brown (1984) page 28 (as *T. fuscolutea* var. *fuscolutea*); Bates & Weber (1990) plate 201; Hoffman & Brown (1992) page 242; Backhouse & Jeanes (1995) page 332; Hoffman & Brown (1998) page 242; Jeanes & Backhouse (2004) page 95.

Glabrous terrestrial herb. *Tubers* ovoid or obovoid, fleshy. *Leaf* ovate-lanceolate to ovate, 5–25 cm long, 8–55 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. *Scape* 10–55 cm tall, 1.4–5 mm diam., more or less straight, green. *Sterile bracts* usually 2, occasionally 3, ovate-lanceolate, 2–10 cm long, 4–20 mm wide, closely sheathing, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 7–35 mm long, 3–9 mm wide, sheathing the pedicels, usually green. *Pedicels* 0.5–15 mm long, slender. *Ovary* narrow-obovoid, 3–13 mm long, 2–4 mm wide, often curved. *Flowers* 1–15, 23–40 mm across, thick-textured, yellow or greenish usually with reddish brown spots and blotches over entire inner surface, opening freely in warm weather. *Perianth segments* 10–20 mm long, 4–8 mm wide, somewhat concave, both surfaces sparsely covered with tiny bead-like glands, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate to ovate-lanceolate; *lateral sepals* ovate to ovate-lanceolate; *petals* ovate to ovate-lanceolate; *labellum* ovate-lanceolate, often smaller than other segments. *Column* erect from the end of ovary, 6–9 mm long, 4–6 mm wide, yellow or greenish with reddish brown spots, broadly winged, wings deeply dentate along distal margins, teeth 0.2–1.7 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of orange trichomes (each c. 0.5 mm long); *supra-anther lobe* 1.7–2.5 mm long, rod-like with a somewhat swollen clavate apex 0.7–1.3 mm wide and 0.9–1.6 mm thick, yellow and reddish brown, apex rugose, ventral surface papillose at base; *auxiliary lobes* absent; *lateral lobes* digitiform, 1–2 mm long, c. 0.3 mm thick, fleshy, yellow, with 2 similar but slightly thinner and longer basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid, 5–6 mm long, 2–2.5 mm wide, connective produced into a fleshy, curved beak 2.5–3.5 mm long, c. 0.8 mm thick, shallowly s-shaped in profile, extending almost to tip of column; *pollinarium* 2–3 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* white, mealy. *Stigma* situated at base of column, ovate-quadrate, 2–3 mm long, 2–3 mm wide, margins irregular. *Capsules* obovoid, 10–24 mm long, 4–8 mm wide, erect, ribbed. (Fig. 3)

Selected specimens examined: WESTERN AUSTRALIA: Tammin, 28.x.1931, *?Miss Simmonds* s.n. (MEL 573516); Jandakot Swamp, x.1957, *Rex Filson* 42 (MEL 606279); Jarrahdale, x.1929, *B.T. Goadby* s.n. (MEL 1550487); Albany district, 1946, *W.H. Nicholls* s.n. (MEL 1549074); Victoria Desert, 18.ix.1891, *R. Helms* s.n. (MEL 1550489); Manjimup area, x.1946, *W.H. Nicholls* s.n. (MEL 1549067); Bussleton, xi.1946, *W.H. Nicholls* s.n. (MEL 1548972); Albany area, x.1946, *W.H. Nicholls* s.n. (MEL 644475); Disused gravel pit, 4.5 km from Hopetoun on Ravenshorpe Road, 13.x.1998, *M. Bennett* 326 (PERTH 05271541); Reserve 22897, S of

Darlington, 28.x.1977, *A.S. George 14983* (PERTH 272922); King River Road Reserve, 20.xi.1999, *R. Heberle ORG2864* (CANB 631100); East of Cranbourne, property of Frank Smith, xi.1999, *R. Heberle ORG2859 & F. Smith* (CANB 631099). SOUTH AUSTRALIA: Scotts Creek near Mt Lofty, 26.xi.1905, *R.S. Rogers s.n.* (MEL 2016024); Encounter Bay, xi.1894, *Miss Hussey s.n.* (MEL 114396); Port Lincoln, 1875, *J.L. Browne s.n.* (MEL 1551045); Mt Lofty, x.1917, *A.C.F. Gates s.n.* (MEL 221706); Onkaparinga, 20.xi.1895, *F. Mueller s.n.* (MEL 1550491); Kangaroo Island, x.1885, *Horswell s.n.* (MEL 1550490); Mt Lofty, 16.xi.1906, *R.S. Rogers s.n.* (PERTH 300144); Mt Lofty, xi.1906, *R.S. Rogers s.n.* (NSW 462459); Deep Creek Conservation Park to Cape Jervis, x.1991, *R.J. Bates 26202* (AD 99147324); Kangaroo Island: Pandara, 1.xi.1986, *R.J. Bates 7526* (AD RBK1); Eyre Peninsula: Stamford Hill in Port Lincoln, 28.x.1990, *R.J. Bates 24862* (AD 99108271); South East: Big Heath National Park, north-eastern part, 5.xi.1969, *J.Z. Weber 1776* (AD 97014390). VICTORIA: Wilsons Promontory National Park, 8.xi.1983, *A.C. Beauglehole 75252 & J. Eichler* (MEL 1531719); 5 miles NE of Anglesea, 20.xi.1955, *J.H. Willis s.n.* (MEL 1550484); Aireys Inlet, 14.xi.1927, *M. Sutherland s.n.* (MEL 625477); Grampians, Victoria Range, near junction of Hamilton waterworks road & Brown's Creek track, 22.xi.1964, *A.H. Corrick s.n.* (MEL 665161); Wannon Valley, ?*L. Banfield s.n.* (MEL 236700); Woolwash Road, Mt Clay, 21.xi.1983, *C. & D. Woolcock 1503* (MEL 660342); Portland, 19.xi.1934, *F. Mellblom s.n.* (MEL 650427); Wilsons Promontory, xi.1931, *E. Devonshire s.n.* (MEL 625272); Ararat, 10.xi.1932, *W.L. Williams s.n.* (AD 97721170). TASMANIA: Centre Hill, Melrose Road, Flinders Island, 30.x.2000, *H. Wapstra s.n.* (HO 516737, HO 516738 & MEL 2198341).

Distribution and habitat: Western Australia, South Australia, Victoria and Tasmania (Flinders Island). Grows mainly in heathlands, open forests and heathy woodlands mostly on well-drained sand and clay loams. Flowering is strongly fire-stimulated in the eastern States. Altitude: 0–300 m.

Conservation status: Common in Western Australia, but generally uncommon in the eastern States. Widespread and well conserved.

Flowering period: September to November.

Pollination biology: The readiness with which this species produces seed capsules would indicate that it is most likely facultatively autogamous.

Notes: *Thelymitra benthamiana* is a generally early flowering member of the *T. fuscolutea* complex from a variety of dry and moist habitats of southern Australia. See Table 2 for other distinguishing features. It is the only species in the group to occur in eastern Australia. Plants display considerable variation across the range, particularly in terms of flower colour and the shape of the supra-anther lobe of the column.

3. *Thelymitra jacksonii* Hopper & A.P.Br. ex Jeanes *sp. nov.*

T. stellatae Lindl. affinis sed distributione plus meridionali, florescentia serotiniore, floribus fusciori, lobo supra-antheram columnae apice clavato crassiori differt.

Type: Western Australia. Beside South West Highway near Broke Inlet Rd, 15.xii.1996, *W. Jackson BJ381* (holotype PERTH 5503388, isotypes PERTH 5503396 & CANB).

Illustrations: Hoffman & Brown (1992) p. 245; Hoffman & Brown (1998) p. 245

Glabrous terrestrial *herb*. *Tubers* not seen. *Leaf* ovate-lanceolate to ovate, 6–12 cm long, 9–20 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. *Scape* 19–35 cm tall, 1.4–2 mm diam., more or less straight, green. *Sterile bracts* usually 2, occasionally 3, ovate-lanceolate, 2–7 cm long, 4–8 mm wide, closely sheathing, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 10–25 mm long, 4–7 mm wide, sheathing

the pedicels, green or purplish. *Pedicels* 4–12 mm long, slender. *Ovary* narrow-obovoid, 10–15 mm long, 3–4 mm wide, often curved. *Flowers* 2–5, 44–56 mm across, thick-textured, dark golden-brown with large yellow blotches and striations, sweetly scented, opening freely in warm weather. *Perianth segments* 16–27 mm long, 4–8 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate-lanceolate to lanceolate; *lateral sepals* ovate-lanceolate to lanceolate, slightly asymmetric; *petals* ovate-lanceolate to lanceolate, slightly asymmetric; *labellum* lanceolate, smaller than other segments. *Column* erect from the end of ovary, 9–12 mm long, 5–7 mm wide, golden brown at base, orange towards apex, broadly winged, wings deeply dentate along distal margins, teeth 0.1–2.5 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of orange trichomes (each c. 0.4 mm long), *supra-anther lobe* 3–4 mm long, rod-like with a swollen clavate apex 2–2.5 mm wide and 2–3 mm thick, orange, apex often bilobed, ridged, rugose to warty, ventral surface papillose towards base; *auxiliary lobes* absent; *lateral lobes* digitiform, 2–2.6 mm long, c. 0.3 mm thick, fleshy, orange, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid, 5.5–6.5 mm long, 2–2.5 mm wide, connective produced into a fleshy, curved beak 3–4 mm long, c. 1.5 mm thick, shallowly s-shaped in profile, extending almost to tip of column; *pollinarium* 2–3 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* white, coherent. *Stigma* situated at base of column, ovate-quadrangle, 3–3.5 mm long, 3–3.5 mm wide, margins irregular. *Capsules* obovoid, 10–20 mm long, 4–8 mm wide, erect, ribbed. (Fig. 4)

Specimens examined: WESTERN AUSTRALIA: Beardmore Road, 24 km NW of Walpole, 22.xii.1994, W. Jackson BJ310 (PERTH 4279689); Aircraft Road, E side, at junction with Preston Road, 15.xii.1995, W. Jackson BJ379 (PERTH 4449894); c. 1 km NW of Beardmore Road, along South West Highway, 27.xii.1995, W. Jackson BJ377 (PERTH 4449754); Darling district c. 26 km NW of Walpole, 14.xii.1993, B. Jackson DLJ12753 (CANB 9603659); Walpole area, 18.xii.2000, W. Jackson JAJ983 (MEL 2143918).

Distribution and habitat: Endemic to southwestern Western Australia, in the vicinity of Walpole. Grows around the edges of winter-wet depressions in sandy-clay soil. Altitude: c. 80 m.

Conservation status: Confined to a limited range with few known populations. Suggest 2EC by criteria of Briggs & Leigh (1996), and Endangered (E) by criteria of IUCN (2000).

Flowering period: December and January.

Pollination biology: The large, freely opening flowers and sporadic capsule production would suggest that the species is probably entomophilous.

Notes: *Thelymitra jacksonii* is a late flowering member of the *T. fuscolutea* complex from generally moist habitats. See Table 2 for other distinguishing features.

Etymology: After the late William (Bill) Jackson (1929–2002), local field naturalist who discovered the species. Bill was of great assistance during my field work in Western Australia, and also supplied me with specimens of various species of *Thelymitra* for my research.

4. *Thelymitra magnifica* Jeanes, sp. nov.

T. stellatae Lindl. affinis sed floresecentia praecociore, floribus leviter majoribus, lobo supra-antheram columnae apice clavato tumidiore differt.

Type: Western Australia. Crystal Brook, 15.x.2000, J.A. Jeanes 841 (holotype MEL 2087468, isotypes MEL 2087469 & PERTH).

Illustration: Hoffman & Brown (1998) page 454 (as *Thelymitra* aff. *stellata*).

Glabrous terrestrial *herb*. *Tubers* not seen. *Leaf* ovate-lanceolate to ovate, 6–15 cm long, 10–25 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. *Scape* 20–35 cm tall, 1.5–2.5 mm diam., more or less straight, usually green. *Sterile bracts* usually 2, lanceolate to ovate-lanceolate, 2–8 cm long, 4–8 mm wide, closely sheathing at base, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 10–35 mm long, 4–7 mm wide, sheathing the pedicels, usually green. *Pedicels* 4–10 mm long, slender. *Ovary* narrow-obovoid, 10–15 mm long, 3–4 mm wide, often curved. *Flowers* 2–7, 44–56 mm across, thick-textured, dark golden-brown with large yellow blotches and stripes, cinnamon scented, opening freely in warm weather. *Perianth segments* 16–28 mm long, 4–8 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate-lanceolate to lanceolate; *lateral sepals* ovate-lanceolate to lanceolate, asymmetric; *petals* ovate-lanceolate to lanceolate, slightly asymmetric; *labellum* lanceolate, smaller than other segments. *Column* erect from the end of ovary, 7–9 mm long, 5–6 mm wide, golden brown at base, yellow towards apex, broadly winged, wings deeply dentate along distal margins, teeth 0.3–2.5 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of orange trichomes (each c. 0.4 mm long); *supra-anther lobe* 2.5–3.5 mm long, rod-like with a swollen clavate apex 1.2–1.5 mm wide and 1.5–2.5 mm thick, orange, apex rugose to warty, ventral surface papillose towards base; *auxiliary lobes* absent; *lateral lobes* digitiform, 2–2.5 mm long, c. 0.3 mm thick, fleshy, orange, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid, 5.5–6 mm long, 2.5–3 mm wide, connective produced into a fleshy, curved beak 2.5–3 mm long, c. 1.4 mm wide, shallowly s-shaped in profile, extending almost to tip of column; *pollinarium* 2.5–3.5 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* coherent, white. *Stigma* situated at base of column, ovate-quadrangle, 3–4 mm long, 2.8–3.5 mm wide, margins irregular. *Capsules* not seen. (Fig. 5)

Specimens examined: WESTERN AUSTRALIA: Near Kalanumba [Kalamunda], stony ridges, x.1931, B.T. Goadby s.n. (PERTH 272450); Maida Vale, x.1932, B.T. Goadby s.n. (PERTH 306045); Armadale, T.M. Burgess s.n. (PERTH 272361).

Distribution and habitat: Endemic to southwestern Western Australia, on the western escarpment of the Darling Ranges between Gooseberry Hill and Armadale. Grows on slopes in seasonally moist sandy clay and granite soils in the vicinity of *Eucalyptus wandoo* trees amongst low shrubs. Altitude: 100–250 m.

Conservation status: Extremely rare and known from a very limited geographic range. Suggest 2E by criteria of Briggs & Leigh (1996), and Endangered (E) by criteria of IUCN (2000).

Flowering period: September and October.

Pollination biology: The large, freely opening flowers and spasmodic capsule production would suggest that the species is probably entomophilous.

Notes: *Thelymitra magnifica* is an early flowering member of the *T. fincolntea* complex from seasonally moist granitic slopes in the Darling Ranges. See Table 2 for other distinguishing features.

Etymology: Latin *magnifica*; noble, eminent, stately; this is a very striking and beautiful species.

5. *Thelymitra dedmaniarum* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 62: 13 (1938)—as *Thelymitra Dedmaniae*.

Type: Western Australia, Toodyay, 11.xi.1934, *Mrs & Miss Dedman s.n.* (lectotype AD 97722521/1!, *hic designatus*; isolectotype AD 97722521/2!).

Illustrations: Hoffman & Brown (1992) page 243 (as *T. dedmaniae*); Hoffman & Brown (1998) page 243 (as *T. aff. dedmaniarum*); Phillimore *et al* (1999) front cover (as *T. manginii*).

Glabrous terrestrial *herb*. *Tubers* not seen. *Leaf* ovate-lanceolate to ovate, 5–25 cm long, 10–35 mm wide, erect or obliquely erect, blade flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. *Scape* 25–55 cm tall, 2–3.5 mm diam., slender to stout, straight, green. *Sterile bracts* usually 2, occasionally 3, lanceolate, 2.5–9 cm long, 4–10 mm wide, closely sheathing at base, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 7–35 mm long, 3–9 mm wide, sheathing the pedicels, usually green. *Pedicels* 1–15 mm long, slender. *Ovary* narrow-obovoid, 6–12 mm long, 1.5–4 mm wide, curved. *Flowers* 2–12, 28–55 mm across, thick-textured, golden yellow, often reddish brown towards the centre, cinnamon scented, opening freely in warm weather. *Perianth segments* 12–28 mm long, 3–10 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate-lanceolate to lanceolate; *lateral sepals* ovate-lanceolate to lanceolate, asymmetric; *petals* ovate-lanceolate to lanceolate, asymmetric; *labellum* lanceolate, often somewhat smaller than other segments. *Column* erect from the end of ovary, 6–9 mm long, 5–8 mm wide, yellow, broadly winged, wings deeply dentate along distal margins, teeth 0.1–2 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of orange trichomes (each c. 0.4 mm long); *supra-anther lobe* 2–3 mm long, yellow, rod-like with a swollen clavate notched apex 1–2.2 mm wide, 1.5–3 mm thick, apex rugose, ventral surface papillose at base; *auxiliary lobes* absent; *lateral lobes* digitiform, 1–2.5 mm long, c. 0.4 mm thick, fleshy, yellow, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid, 5–7 mm long, 2–3.5 mm wide, connective produced into a fleshy, curved beak 2.5–3.5 mm long, c. 2 mm thick, shallowly s-shaped in profile, extending to tip of column; *pollinarium* 2–4 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* coherent, white. *Stigma* situated at base of column, ovate-quadrate, 3–4 mm long, 3–4.5 mm wide, margins irregular. *Capsules* not seen. (Fig. 6)

Specimens examined: WESTERN AUSTRALIA: Shire Recreation Reserve No 26865, Gidgegannup, 13.xi.1992, *J.L. Robson s.n.* (PERTH 4221435); Near Gidgegannup, 18.xi.1962, *E.W. Witmer* 82 (PERTH 272388); Wooreloo, xi.1907, *M. Koch s.n.* (NSW 181304 & NSW 462472); Susannah Ck, Red Hill, 27.x.1963, *F. Humphreys s.n.* (PERTH 271993).

Distribution and habitat: Endemic to southwestern Western Australia where known only from the Red Hill to Wooreloo area east of Perth. Grows in *E. wandoo* and *Encalyptus accedens* woodlands on red/brown sandy loam soil associated with dolerite and granite outcrops. Altitude: 100–250 m.

Conservation status: Extremely localised, critically endangered and declared as Rare Flora in Western Australia. Suggest 2E by criteria of Briggs & Leigh (1996), and Critically Endangered (CR) by criteria of IUCN (2000).

Flowering period: Late October and November.

Pollination biology: The large, freely opening flowers and spasmodic capsule production would suggest that the species is probably entomophilous.

Notes: *Thelymitra dedmaniarum* is a mid- to late-flowering member of the *T. fuscolutea* complex from dry habitats. See Table 2 for other distinguishing features.

The common name 'Cinnamon Sun Orchid' has been applied to this species.

6. *Thelymitra yorkensis* Jeanes sp. nov.

T. stellatae Lindl. affinis sed ad sylvis Eucalypti wandoo magnopere limitato, florescentia leviter scrotiniore, floribus paucioribus magis late dispositis cinnameis differt.

Type: Population 7. Kent Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (holotype PERTH 4858301).

Thelymitra dedmaniarum sensu Hoffman & Brown (1998), non R.S. Rogers.

Illustrations: Hort (1997) front cover, p.7 (both as *T. dedmaniarum*) & p. 11 (as *T. ?stellata*); Hoffman & Brown (1998) page 451 (as *T. dedmaniarum*).

Glabrous terrestrial herb. Tubers ovoid or obovoid, 1–4 cm long, 5–15 mm wide, fleshy. Leaf ovate-lanceolate to ovate, 5–20 cm long, 9–30 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. Scape 14–45 cm tall, 1.2–3 mm diam., more or less straight, green. Sterile bracts usually 2, occasionally 3, ovate-lanceolate, 2.5–8.5 cm long, 4–10 mm wide, closely sheathing, usually green, apex often free and diverging from scape, acuminate. Fertile bracts ovate-acuminate to obovate-acuminate, 9–31 mm long, 4–9 mm wide, sheathing pedicels, green or purplish. Pedicels 1–13 mm long, slender. Ovary narrow-obovoid, 6–11 mm long, 2–4 mm wide, often curved. Flowers 2–8, 38–54 mm across, thick-textured, orange with reddish brown edges, cinnamon scented, opening freely in warm weather. Perianth segments 13–26 mm long, 3.5–8 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; dorsal sepal ovate-lanceolate to lanceolate; lateral sepals ovate-lanceolate to lanceolate, slightly asymmetric; petals ovate-lanceolate to lanceolate, slightly asymmetric; labellum lanceolate, often smaller than other segments. Column erect from the end of ovary, 6–8 mm long, 4.5–7 mm wide, yellowish at base, orange towards apex, broadly winged, wings deeply dentate along distal margins, teeth 0.2–2 mm long; post-anther lobe with dorsal surface covered by a dense mass of orange trichomes (each c. 0.4 mm long); supra-anther lobe 2–3 mm long, rod-like with a swollen clavate apex 0.8–1.3 mm wide, 1.2–1.7 mm thick, orange, apex rugose to warty, ventral surface papillose at base; auxiliary lobes absent; lateral lobes digitiform, 1–2.7 mm long, c. 0.3 mm thick, fleshy, orange, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. Anther inserted towards base of column, partly obscured behind stigma, ovoid, 4.5–5.7 mm long, 2–2.5 mm wide, shallowly s-shaped in profile, connective produced into a fleshy, curved beak 2.5–3 mm long, c. 1.5 mm thick, extending almost to tip of column; pollinarium 2–3 mm long; viscidium almost round, c. 0.6 mm diam.; pollinia white, coherent. Stigma situated at base of

column, ovate-quadrate, 2.2–3.5 mm long, 2.4–4 mm wide, margins irregular. *Capsules* obovoid, 10–20 mm long, 4–8 mm wide, erect, ribbed. (Fig. 7)

Selected specimens examined: WESTERN AUSTRALIA: Dodaderry Nature Reserve number 37306, 8.xi.1991, J.L. Robson s.n. (PERTH 1661981); Population 12. Kent Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858247); Population 10. Kent Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858239); Population 6. Kent Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858336); Population 9. Nuytsia Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858263); Population 5. Kent Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858344); Population 8. Nuytsia Road, SW of York, 20.xi.1996, K. Kershaw & F. Hort s.n. (PERTH 4858271); Darling district, Kent Road. Talbot, 7.xi.1996, F. Hort & J. Hort ORG410 (CANB 611708); Qualen Road, SW of York, 4.xi.2000, C.J. French 2796 (MEL 2143919).

Distribution and habitat: Endemic to southwestern Western Australia, in a small area south-west of York. Grows in open *E. wandoo* and *E. accedens* woodland on granitic or laterite ridges and slopes. Altitude: 250–400 m.

Conservation status: Confined to a limited range with about 12 known populations. Suggest 2EC by criteria of Briggs & Leigh (1996), and Endangered (E) by criteria of IUCN (2000).

Flowering period: Late October to early December.

Pollination biology: The large, freely opening flowers and sporadic capsule production would suggest that the species is probably entomophilous.

Notes: *Thelymitra yorkensis* has been confused with *T. dedmaniarum*, but the two species are distinct. The former usually has strongly bicolorous flowers, while in the latter the flowers are fairly uniformly golden yellow. See Table 2 for other distinguishing features.

The common name ‘Bronze Orchid’ has been applied to this species.

Etymology: From the town of York, Western Australia, near which all the currently known populations have been located.

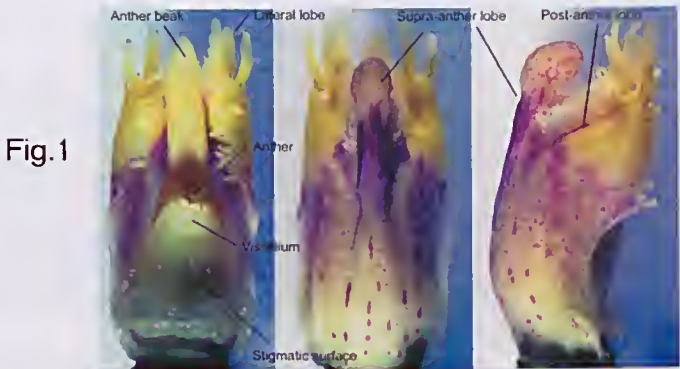
7. *Thelymitra stellata* Lindl., Edwards’s Bot. Reg. appendix to vols. 1–23 [Sketch Veg. Swan R.]: 49 (1839-1840).

Type: ‘Swan River’, 1839, J. Drummond s.n. (holotype K-L!, isotypes BM!, FI!, K, AD!).

Thelymitra fuscolutea R.Br. var. *stellata* (Lindl.) A.S.George, *Nuytsia* 1(2): 194 (1971).

Illustrations: Hoffman & Brown (1984) page 30 (as *T. fuscolutea* var. *stellata*); Jones (1988) page 304; Hoffman & Brown (1992) page 244; Hoffman & Brown (1998) page 244.

Glabrous terrestrial herb. *Tubers* ovoid or obovoid, 1–3 cm long, 5–15 mm wide, fleshy. *Leaf* ovate-lanceolate to ovate, 5–20 cm long, 10–35 mm wide, erect or obliquely erect, blade more or less flat, leathery, bright green to yellowish green, sheathing at base, apex subacute to acute, sometimes shortly apiculate. *Scape* 15–45 cm tall, 1.4–3.5 mm diam., more or less straight, green. *Sterile bracts* usually 2, occasionally 3, ovate-lanceolate, 2–7 cm long, 3–10 mm wide, closely sheathing, usually green, apex often free and diverging from scape, acuminate. *Fertile bracts* ovate-acuminate to obovate-acuminate, 7–35 mm long, 3–7 mm wide, sheathing the



Figures 1-4. Fig.1. Column features of *Thelymitra benthamiana*. From left to right: ventral, dorsal and lateral views (photographs by Jeff Jeanes). Fig. 2. *Thelymitra fuscolutea* (photograph by Andrew Brown, Western Australia). Fig. 3. *Thelymitra benthamiana* (photograph by Jeff Jeanes). Fig. 4. *Thelymitra jacksonii* (photograph by Andrew Brown, Department of Environment and Conservation, Western Australia).



Figures 5-8. **Fig. 5.** *Thelymitra magnifica* (photograph by Jeff Jeanes). **Fig. 6.** *Thelymitra dedmaniarum* (photograph by Andrew Brown, Department of Environment and Conservation, Western Australia). **Fig. 7.** *Thelymitra yorkensis* (photograph by Andrew Brown, Department of Environment and Conservation, Western Australia). **Fig. 8.** *Thelymitra stellata* (photograph by Andrew Brown, Department of Environment and Conservation, Western Australia).

pedicels, green or purplish. *Pedicels* 5–12 mm long, slender. *Ovary* narrow-obovoid, 6–13 mm long, 1.5–3.5 mm wide, often curved. *Flowers* 2–12, 28–45 mm across, thick-textured, brown to reddish brown with large yellow blotches and stripes on inner surface, sweetly scented, opening freely in warm weather. *Perianth segments* 12–22 mm long, 3–7 mm wide, more or less flat, both surfaces sparsely covered with tiny bead-like glands, apex often slightly twisted, acute to shortly acuminate, often shortly apiculate; *dorsal sepal* ovate-lanceolate to lanceolate; *lateral sepals* ovate-lanceolate to lanceolate, slightly asymmetric; *petals* ovate-lanceolate to lanceolate, slightly asymmetric; *labellum* lanceolate, often smaller than other segments. *Column* erect from the end of ovary, 5.5–8 mm long, 3–5 mm wide, orange-brown at base, orange towards apex, broadly winged, wings deeply dentate along distal margins, teeth 0.3–2 mm long; *post-anther lobe* with dorsal surface covered by a dense mass of orange trichomes (each c. 0.3 mm long); *supra-anther lobe* 2–3 mm long, rod-like with a swollen clavate notched apex 0.7–1.2 mm wide and 1.1–1.5 mm thick, orange, apex rugose to warty, ventral surface papillose at base; *auxiliary lobes* absent; *lateral lobes* digitiform, 1.5–2 mm long, c. 0.3 mm thick, fleshy, orange, with 2 similar but slightly thinner basal lobes that are entire or, less often, divided. *Anther* inserted towards base of column, partly obscured behind stigma, ovoid, 4.5–5.5 mm long, 1.8–2.3 mm wide, connective produced into a fleshy, curved beak 2–3 mm long, c. 1.2 mm thick, shallowly s-shaped in profile, extending almost to tip of column; *pollinarium* 2–3 mm long; *viscidium* almost round, c. 0.6 mm diam.; *pollinia* coherent, white. *Stigma* situated at base of column, ovate-quadrate, 2.5–3.5 mm long, 2–3 mm wide, margins irregular. *Capsules* obovoid, 10–20 mm long, 4–8 mm wide, erect, ribbed. (Fig. 8)

Specimens examined: WESTERN AUSTRALIA: Southern foot of Mt Lesueur, Hill River district, 7.x.1961, *J.H. Willis s.n.* (MEL 221757 & PERTH 272418); East of Greenhead on road leading out to Brand Highway, 21.x.1996, *B.A. Fuhrer 96/65* (MEL 2038912); Darling Range, *B.T. Goadby s.n.* (PERTH 272442); Hill ENE of Mt Peron, NE of Jurien, 24.x.1979, *E.A. Griffin 2442* (PERTH 272868); S of Jurien Rd, W of Brand Highway, 14.x.1979, *E.A. Griffin 2411* (PERTH 272426); Forestfield, 17.x.1978, *R.J. Cranfield 900* (PERTH 306037); Mundaring, *S.A. White s.n.* (AD 97732392); Belevue, 31.x.1930, *W. Dedman s.n.* (AD 97721168); Stirling District: Lake Grace (cultivated), 22.xi.1978, *M.A. Clements s.n.* (CANB 7905118); Arthur River, *J. Smith s.n.* (PERTH 4620178); Swan River, 1843, *J. Drummond 825* (P 220064); Darling District: N of Armidale, 22.xi.1998, *R. Heberle ORG1872* (CANB 611739).

Distribution and habitat: Endemic to southwestern Western Australia, mostly between Three Springs and Pinjarra; and with isolated records from near Arthur River, Corrigin and Dumbleyung (A. Brown, pers. comm.). Grows amongst low shrubs in Jarrah forest or in low heath on rocky lateritic hill tops. Substrates are lateritic loams or gravelly or sandy soils. Altitude: 20–200 m.

Conservation status: Known from a small number of plants at very few sites and Declared as Rare Flora in Western Australia. Suggest 3EC by criteria of Briggs & Leigh (1996), and Endangered (E) by criteria of IUCN (2000).

Flowering period: October and November

Pollination biology: The large, freely opening flowers and sporadic capsule production would suggest that the species is probably entomophilous.

Notes: *Thelymitra stellata* is a generally mid flowering member of the *T. fuscolutea* complex from dry habitats. See Table 2 for other distinguishing features.

Acknowledgments

I am grateful to the Australian Biological Resources Study (ABRS) and the Australian Orchid Foundation (AOF) for their financial support of my work on *Thelymitra* during 2000, 2001 and 2002. I wish to thank Bob Bates, Andrew Batty (KPBG, UWA), Gary Brockman (PERTH), Andrew Brown (DEC), Mark Clements (CSIRO), Kingsley Dixon (BGPA), John Eichler, Chris and Marie French, †Ron Heberle, Fred Hort, †Bill and Gloria Jackson, David (CSIRO) and Barbara Jones, Margaret MacDonald, Clive and Merle Trigg, Hans and Annic Wapstra for supplying me with locality information, specimens or photographs of the new taxa. My colleague Neville Walsh (MEL) kindly wrote the Latin diagnoses and made helpful comments on the text. Niels Klazenga (MEL) helped with the intricacies of Photoshop. Thanks also to the directors and curatorial staff at AD, BM, BRI, CANB, E, HO, MEL, NSW, P, PERTH, QRS, SUNIV and WELT for access to specimens. I am also grateful to the two anonymous referees for their constructive comments.

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Winifred Mary Curtis 1905-2005

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Winifred Mary Curtis was born June 15th, 1905, in London, England, the only child of Herbert John and Elizabeth Mary Curtis. Her parents were the sort who believed that girls should have the same educational advantages as boys, something unusual for those early years of the twentieth century. They gave her every opportunity to study as she wished, for which she always paid them tribute.

The First World War had a great influence on her life in that it was her generation that was literally culled of men. In later life, when asked why she had remained unmarried, she simply remarked “there weren’t the men - they were all killed in the war”. The war had other impacts as well, in that it altered opportunities for women to obtain employment in traditionally male domains such as industry, education and the civil service.

The Curtis family moved frequently and, in 1920, Herbert Curtis was stationed in India. Winifred spent two years at a boarding school at Naini Tal in the eastern Himalayas. It was a very cosmopolitan school, established primarily for the daughters of American missionaries. She returned to London in 1922 to complete her matriculation and, in 1924, enrolled at University College London to study botany, chemistry, mathematics and physics. Botany became her central interest more by virtue of her doing well at it rather than through any specific love for the topic. It brought her several awards that contributed to paying for text books and fees. Winifred graduated from University College London with a BSc (Hons) degree in 1928. She subsequently gained a MSc (1939), PhD (1950) and DSc (1968) from the same institution. She learnt

her Botany from a number of distinguished individuals who were pioneers in their fields: palaeobotanist Francis Oliver, ecologists Sir Arthur Tansley and Edward Salisbury, phycologist Felix Fritsch and mycologist Dame Helen Gwynne-Vaughan. It was this illustrious scientific tradition that Winifred later imported into Tasmania when she arrived with her parents in 1939.

Her first research work, undertaken for Honours under the supervision of Professor Oliver, was on the origin and status of the grass then known as *Spartina townsendii*. Later work concentrated on apomicts in *Taraxacum*. However, academic employment was difficult to obtain in the United Kingdom, and she supported herself during these early years by teaching science at various girls' High Schools.

The decision to come to Tasmania was rather fortuitous. Her father had planned to retire to one of the British dominions where the climate was milder. The family's preferences were for Tasmania, New Zealand or Vancouver. Winifred wrote to all the relevant universities, and the most promising response came from Tasmania, from Dr V.V. Hickman, Head of the Biology Department at the University of Tasmania. He offered her a part-time position as a Demonstrator, only the second academic appointment to be held by a woman at the University. Much as she had done in England, she also obtained a part-time job as Science Mistress at Hobart's Fahan School. The Second World War now played a hand in her life for, in 1943, the Australian Government decided it needed more doctors, and medical students were required to study Botany in the early part of their training. Winifred was offered a full-time position at the University because, with a brand new Botany Department only recently established, there was nobody available to teach at University level other than this young, newly-arrived Englishwoman.



Figure 1. In the field at The Springs, Mt Wellington, Tasmania in 1941.

From 1942 to 1966, she worked at the University of Tasmania, becoming Assistant Lecturer in 1942, Lecturer in 1945, Senior Lecturer in 1951 and Reader in 1956, the first woman at the University to attain this rank. Perhaps more significantly, she was also the first woman at the University of Tasmania to head an academic department, serving as Acting Head of Botany in 1947, 1954, 1961, 1964 and, in her final year of employment, in 1966. Winifred Curtis enjoyed a reputation for being an exacting and formidable teacher, but she had great fondness for her students and earned their long-lasting respect in return. She continued to receive letters and visits from many former students throughout her life.

Winifred Curtis was a pioneer researcher in plant embryology and cytology, being the first to apply these disciplines to Australian plant species. Her chief contributions, however, were to plant taxonomy. In 1943, in response to a need for a new flora of Tasmania to update Leonard Rodway's 1903 publication, she commenced work on *The Student's Flora of Tasmania*. It became the definitive handbook on Tasmania's flowering plants and conifers. The first volume was published in 1956, the fifth (and final) volume in 1994. From the 1970s, she co-operated closely with her close friend, the late Dr Dennis Morris, who co-authored the final volumes and who predeceased her by just a few months.

Curtis's contributions to Tasmania and Tasmanian Botany are enormous. She taught generations of students, and today her legacy lives on through cohorts of professional and amateur biologists who were taught either directly by her, or by her students such as the late Professor Bill Jackson. Her *Student's Flora* remains the fundamental text for all students and lovers of Tasmanian plants. Her six-volume *Endemic Flora of Tasmania* (1967-1978), produced jointly with renowned botanical artist Margaret Stones and sponsored by the late Lord Talbot de Malahide, is not only a scholarly work but also a masterpiece of botanical art and a much-sought collector's item. Her *Biology for Australian Students*, a high school text first published in 1948, served generations of school biology classes. This was a book that she had written out of frustration at having to teach from English-based texts; ironically she never taught from it herself.

Winifred Curtis worked tirelessly towards the security of Tasmania's botanical collections and the establishment of the Tasmanian Herbarium at the Tasmanian Museum and Art Gallery. In 1941, she had been part-time Keeper, working on Saturday afternoons at the Royal Tasmanian Botanical Gardens in a small wooden hut where the Herbarium collections were housed. When the collections were lent to the University to facilitate her preparation of the *Student's Flora*, she maintained responsibility for them, adding more than 6,000 specimens herself. These she collected on excursions in the family car, using buses or walking. In retirement, she continued to work at the Herbarium as an Honorary Botanist for more than 35 years.

Curtis gained many honours and much recognition for her contributions to Tasmania, including the Royal Society of Tasmania's Clive Lord Memorial Medal (1966), the Australian Natural History Medallion (1976), membership of the Order of Australia (1977), an honorary DSc from the University of Tasmania (1987), the Australian Plants Award (1988), the ANZAAS Mueller Medal (1994), and Hobart Citizen of the Year (1997). In 1991, the Royal Society of Tasmania published a commemorative volume to mark her 85th birthday; it featured more than 30 papers by colleagues, friends and former students. In memory of her contribution to the teaching of botany, the University of Tasmania's School of Plant Science established the *Winifred Curtis Prize* in 1990, awarded to the student who demonstrated the greatest proficiency in first year Plant Science courses. A teaching laboratory at the School has been named the *Curtis Laboratory* in her honour. Her name is also commemorated by

several Tasmanian vascular plants, and in the *Winifred Curtis Scamander Reserve* on Tasmania's East Coast. Her contributions were not only to botany but also to teaching in general and to the advancement of women in education. She remained deeply aware of the privileges of the educational opportunities she received, being of only the third generation of women to have access to higher education. In turn, she tried to pass on this awareness to others, and strived for fairness and equal opportunity.



Figures 2-3: **Fig. 2.** With artist Margaret Stones (left) at the Hartz Mountains, Tasmania, in the 1980s. **Fig. 3.** With friend and colleague Dennis Morris at the launch of the fifth and final volume of their *Student's Flora* in 1994. Photograph courtesy of *The Mercury*, Hobart.

The passing of Winifred Curtis, on October 14th, 2005, marks the closing of a chapter in the annals of Tasmanian Botany. She outlived her peers and most of her students, and the challenge for the younger generation is to carry her work and principles forward. Winifred embodied the principle of sticking to a task to the end; in the case of the *Student's Flora* it took her more than 50 years, something she did not realise when taking it on in 1943. She had an unwavering belief in what needed to be done, even in the face of adversity, or as was more likely the case, in the face of disinterest or mediocrity; she was always prepared to tackle the highest authority on matters of principle. She will also be remembered for her humility, for the way she conducted her research without fanfare but with a dedication to precision. In her view, her considerable achievements were simply a job that needed to be done, and a foundation for others to build on.

This article is based on two earlier contributions on the life of Winifred Curtis:

Kantvilas, G. (1991). 'Winifred Mary Curtis: a biographical sketch', in M.R. Banks, S.J. Smith, A.E. Orchard and G. Kantvilas (eds), *Aspects of Tasmanian Botany - A Tribute to Winifred Curtis*, pp 1-6. Royal Society of Tasmania: Hobart.

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Austroboletus mutabilis sp. nov. from northern Queensland

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Abstract

Austroboletus mutabilis Halling, Osmundson, & Neves is newly described from dry sclerophyll woodlands on the Atherton Tableland and the Paluma Range of northern Queensland. The diagnostic macroscopic feature that distinguishes this taxon from others in the genus, including sympatric taxa, is the striking colour shift on the pileus from deep red to orange and then yellow. Such a dramatic colour shift is newly described for the genus. The basidiospores possess what appears to be a simple, smooth plage as viewed with light microscopy, but a more complex morphology is revealed when viewed with the scanning electron microscope.

Introduction

Austroboletus appears to be mostly tropical in distribution but taxa are recorded from north temperate regions (Japan and USA), Australasia, as well as Australia, New Caledonia, and New Zealand (Watling & Gregory 1986). Although a coarsely reticulate to lacunose stipe is common on species occurring in western Pacific countries, some, such as *A. gracilis* (Peck) Wolfe, have only a slightly ridged or nearly subglabrous stipe. The spore colour in deposit (vinaceous, porphyry pinkish to lilaceous brown) and conspicuous wall ornamentation are other unifying features of the genus, although the type and degree of ornamentation ranges from scattered isolated pits to meandering fissures with occasional isolated protuberances or there may be obvious solitary wart-like pegs confined to the equator of the fusoid spores. While there have been advances in circumscribing *Austroboletus* and some of its subordinate taxa (Corner 1972 as a subgenus; Wolfe 1979; Horak 1980; Watling & Gregory 1986), none of these papers mention a red austrobolete with a succession of distinctive colour changes.

Below, we describe *Austroboletus mutabilis* as a new species whose pileus exhibits a dramatic colour shift from red through orange to yellow. Microscopically, the suprahilar plage on spores of *A. mutabilis* is conspicuous and appears to lack the obvious ornamentation present on the rest of the spore. While the plage appears smooth under the light microscope, scanning electron micrography shows a large, irregular pit or erosion of that region which seems to develop with maturation. In Wolfe's (1979) compilation of scanning electron micrographs illustrating external spore ultrastructure, no images of taxa portray the intricate detail seen on the suprahilar plage of *A. mutabilis*. The new taxon is currently known from several collections gathered during 1992 in the Paluma Range, and 1992 and 2006 on the Atherton Tableland.

Materials and methods

General colour terms are approximations, and the colour codes (e.g., 7D8) are page, column, and grid designations from Kornerup and Wanscher (1983). All microscopic



Figures 1–2. Habits of *Austroboletus mutabilis*. 1. R. E. Halling 8745 (holotype), $\times 0.75$. 2. R. E. Halling 8768, $\times 0.75$.

structures were observed with an Olympus BHS compound microscope equipped with Nomarski differential interference contrast (DIC) optics, and measured from dried material revived in 3% KOH. The letter abbreviation, Q , refers to the mean length/width ratio measured from n basidiospores, and x , refers to the mean length $\times$ mean width. Fragments of the hymenophore were removed from dried basidiomata, mounted directly on aluminum stubs (EMS#75610) using carbon adhesive tabs (EMS#77825-12), and coated with 10 nm of gold using a Hummer II sputter coater. The basidiospores were examined with a Hitachi S-2700 scanning electron microscope operating at 10KeV. Herbarium acronyms are from Holmgren *et al.* (1990).

Taxonomy

Austroboletus mutabilis Halling, Osmundson & Neves *sp. nov.*

Figs 1–8

A specibus Austroboletorum ubique coloribus pileorum mutabilibus; ut videtur plaga sporarum levi sed vero crasa distinguenda.

Type: Queensland, Mareeba, ± 12 – 15 km E of Kuranda-Mareeba Highway along Davies Creek Road, Davies Creek N.P., $17^{\circ}1'S$, $145^{\circ}35'E$; ± 720 m, 9.ii.2006, R. E. Halling 8745 (holotype BRI; isotype NY).

Pileus (2–)3–6 cm broad, convex or pulvinate to plano-convex, glutinous when young and fresh, soon viscid to subviscid or dry, matted to glabrous beneath the gluten, dark red to brownish red (10B–F8 to 8–9C–D8) when young, soon fading to brownish orange (7B7–5B7 to 7D8), becoming orangish yellow (6C–D8), then eventually yellowish (4A7,6), sometimes with adherent glutinous universal veil remnants at margin. *Flesh* soft, white, unchanging, with mild odor and slightly acidic taste. *Tubes* adnate to adnexed, white at first, soon becoming pale porphyry pinkish brown (7–8C–D5–4), staining brownish yellow when bruised, with *pores* pale pink (7A2) to greyish pink (7B2), staining darker pink or light brown. *Stipe* (4–)6–12 cm long, 5–10(–12) mm broad, equal to slightly broader below, then tapered slightly toward base, dry, white and alveolate-reticulate to lacerate nearly overall, sometimes coarsely so, with ridges slightly finer above and near apex, typically draped (except for apex) with translucent yellow to dull or dark ochraceous to dark honey brown glutinous universal veil remnants, with white, solid interior eventually becoming pithy to slightly hollow, with white basal mycelium. *NH₄OH*: on pileus, immediately grass green on lighter portions; dark green on redder portions, becoming orange at point of application with green halo; negative on flesh; faint pink on glutinous veil that adheres to stipe; negative on stipe surface.

Basidiospores greyish red (9C–D3) to reddish brown (8–9E7) in deposit, 11.9 – 14.7×4.9 – $7 \mu\text{m}$, $Q = 2.23$, $n = 20$, $x = 12.9 \times 5.8 \mu\text{m}$, broadly subfusoid to elongate amygdaliform, with wall minutely pitted, eventually more obviously pitted and dissected by short, meandering fissures that occasionally isolate irregular ridges, with a smooth to conspicuously eroded suprahilar plage, cyanophilic, brownish yellow in KOH, inamyloid or sometimes dextrinoid in mass in Melzer's. *Basidia* 25 – 35×10 – $13 \mu\text{m}$, 4-sterigmate, clavate, hyaline or sometimes with granular content. *Hymenial cystidia* present as scattered, fusoid to lageniform pleurocystidia and abundant, cylindric to elongate-clavate cheilocystidia, without differentiated contents. *Tube trama* boletoid, diverging from a central zone of brownish yellow hyphae, with lateral elements 5 – $8 \mu\text{m}$ broad, becoming gelatinized with age. *Pileipellis* a suberect to erect, tangled trichodermium embedded in a gelatinous matrix; hyphae with a pale brownish pigment dissolving in KOH, non-encrusting and amorphous in Melzer's, with terminal elements

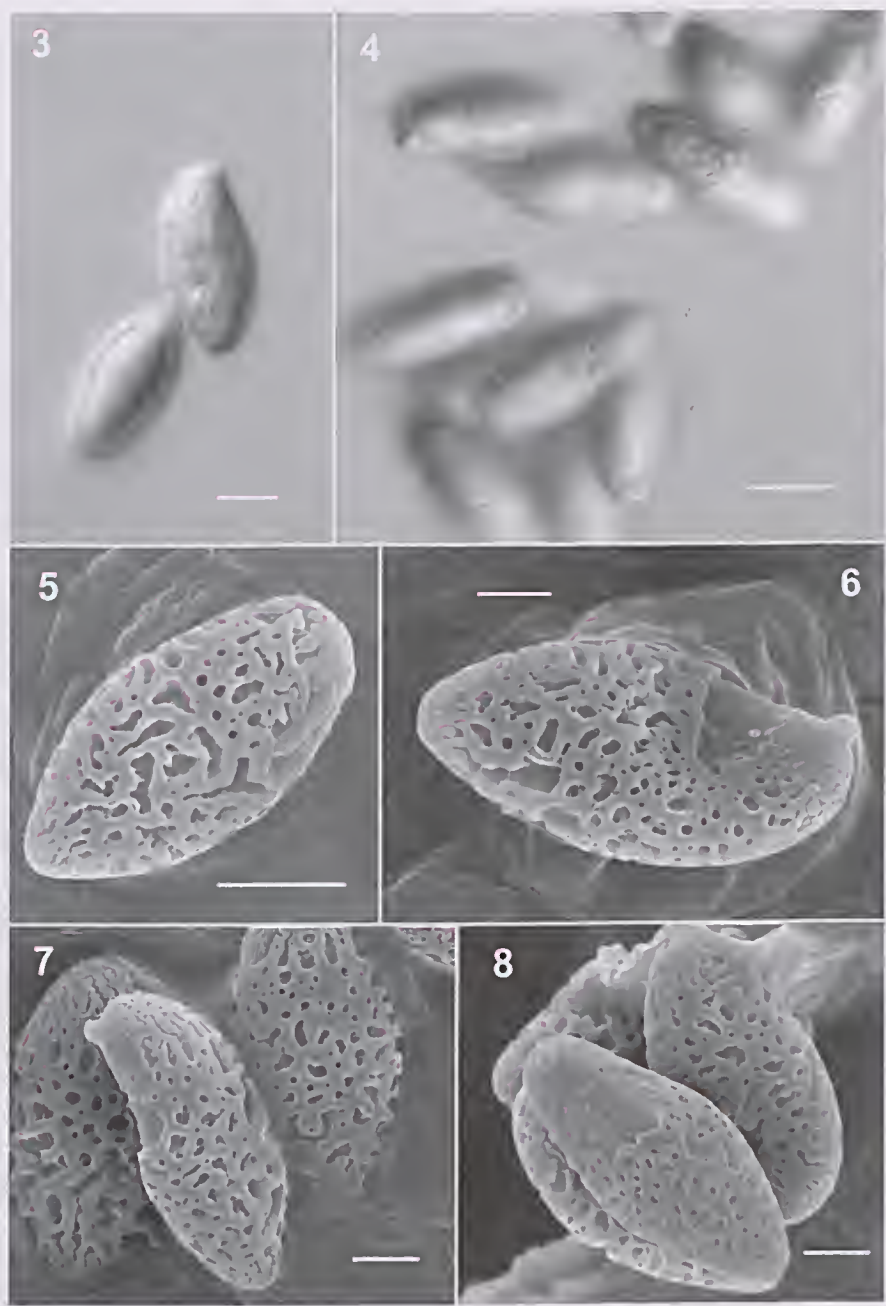
hyaline, smooth and thin-walled, cylindrical to elongate, 3.5–7 μm wide. *Pileus trama* interwoven, hyaline, inamyloid, with elements 5–14 μm wide, smooth, thin-walled. *Stipitipellis* hymeniform, with sphaeropedunculate or short-clavate to elongate clavate cauloecystidia, rarely fusoid to sublageniform and projecting. *Stipe trama hyphae* parallel, cylindric, hyaline, inamyloid. *Clamp connections* absent.

Habit, habitat, and distribution: gregarious to scattered, sometimes solitary, rarely caespitose on coarse, granitic soil in sclerophyll woodlands with *Acacia aulacocarpa* Cunn. ex Benth., *Allocasuarina littoralis* (Salisb.) L. A. S. Johnson, *A. torulosa* (Aiton.) L. A. S. Johnson, *Eucalyptus intermedia* R. Br., and *Xanthostemon* sp. Known from the Paluma Range (Mt. Spee section) north of Townsville and the Atherton Tableland west of Cairns.

Additional specimens examined: QUEENSLAND: ATHERTON: Atherton, Mt. Baldy State Forest, 17°18'32", 145°23'53", 1000 m, 22.ii.2006, T. W. Osmundson 1144 (BRI, NY). MAREEBA: Mareeba, Davies Creek National Park, Davies Creek Road, 17°1'S, 145°36'E; 650–700 m, 5.ii.1992, R. E. Halling 6771 (PERTH, NY), 19.ii.1992, R. E. Halling 6817, 6822, 6835 (PERTH, NY), 4.ii.2006, R. E. Halling 8732 (BRI, NY), 21.ii.2006, R. E. Halling 8768 (BRI, NY), T. W. Osmundson 1139 (BRI, NY). THURINGOWA: Paluma, Paluma Range National Park, 17.ii.1992, R. E. Halling 6795 (PERTH, NY), 18.ii.1992, R. E. Halling 6804, 6813 (PERTH, NY).

Discussion: The major distinguishing macroscopic feature of this austrobolete is the dramatic colour shift on the pileus that occurs as the basidiomata age. While this colour shift may occur as a consequence of time, the shift also appears to be mediated by exposure to light and/or fluctuation in humidity. Without exception, the immature or button stages are dark red and pass through an orange stage and eventually become yellow as the basidiomata mature. Intermediate forms can be found that exhibit combinations of these colours and these appear to result from differential exposure to light and air (i.e., one pileus overlaying a portion of another). Because solitary basidiomata are found that may exhibit only one of the colour phases, collectors and naturalists should be aware of this temporal colour change. Also, the pileus is glutinous at first, but becomes viscid to subviscid and then dries out during maturation and with exposure. The gluten extends from the pileus downward and overlays the stipe when young, then dries and shrinks as the basidiomata expand with maturation. The gluten then is distributed in patches or annular zones. With the light microscope, the suprahilar plage appears smooth on spores that are otherwise conspicuously ornamented with pits and fissures. Ultrastructural detail seen with the scanning electron microscope reveals a smooth suprahilar plage on young spores, which then appears eroded at maturity.

Corner's (1972) aquarelle of *Austroboletus mucosus* (Corner) Wolfe illustrates a similar yellowish pileus colour and deposition of glutinous veil remains as on the stipe of *A. mutabilis*, but *A. mucosus* is tawny brown at first (not red) with a white to cream coloured stipe (not entirely white), and produces spores with isolated verrucae (not with meandering ridges and fissures) restricted to the broad, central portion. Sympatric taxa in Davies Creek National Park include *Austroboletus subvirens* (Hongo) Wolfe [several collections, for example, QUEENSLAND: MAREEBA: Mareeba, Davies Creek National Park, Davies Creek Road, 17°1'31"S, 145°35'52"E; 720 m, 21.ii.2006, R. E. Halling 8772 (BRI, NY)] and *A. lacmosus* (Kuntze) T. W. May & A. E. Wood. The former has a green pileus and stipe ornamentation and the latter is uniformly coloured a cinnamon brown to a light cocoa brown throughout development with a much more complex pattern of reticulation (but not lacerated) on the stipe surface. Other species



Figures 3–8. Spores of *Austroboletus mutabilis* (R. E. Halling 8768). **3.** View with Nomarski DIC, upper right spore with apparent smooth plage in profile, scale bar = 5 μm . **4.** View with Nomarski DIC, spores with apparent smooth plage in adaxial view (bright areas), scale bar = 5 μm . **5.** Abaxial view with SEM, scale bar = 5 μm . **6.** Nearly profile view with SEM; eroded plage, scale bar = 2 μm . **7.** Profile view (centre spore) with SEM; sub-smooth to nearly eroded plage, scale bar = 2 μm . **8.** Adaxial view with SEM; sub-smooth to nearly eroded plage, scale bar = 2 μm .

listed as occurring in Australia (May & Wood 1997), i.e., *A. eburneus*, *A. niveus*, *A. novaezelandiae*, *A. occidentalis*, and *A. subflavidus* do not have red pilei.

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Reinstatement of the northern Australian species *Cleome linophylla* (O. Schwarz) Pax & K.Hoffm. (Capparaceae), and neotypification of its basionym, *Triandrophora linophylla* O.Schwarz

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Abstract

Cleome linophylla (O.Schwarz) Pax & K.Hoffm. is reinstated as a distinct species, a neotype of its basionym, *Triandrophora linophylla* O.Schwartz is chosen, and a description and illustration are presented. The authorship of the taxonomic synonym *C. tetrandra* var. *simplicifolia* Hewson is discussed.

Introduction

The genus *Cleome* L., commonly placed in the family Capparaceae (e.g. Cronquist 1981, Hewson 1982) but perhaps best referred to the Brassicaceae or a separate Cleomaceae (e.g. Judd *et al.* 1999, Hall *et al.* 2002), is widespread in subtropical and pantropical regions of the world, with more than 150 species being recognised. Hewson (1982), recognising ten species, produced the most recent account of the genus in Australia. However, following examination of herbarium specimens and field observations of *Cleome* it has become evident that her treatment does not account for many taxa found in northern Australia. Preliminary sorting of specimens in the Northern Territory Herbarium (DNA) alone suggests that perhaps ten unnamed taxa occur in the N.T. Many of these taxa are currently placed in polymorphic *C. tetrandra* DC.

Hewson, undoubtedly handicapped by not having adequate, well-labelled specimens and by not seeing specimens in the field, recognised three infraspecific taxa within *C. tetrandra*, i.e. var. *tetrandra*, var. *pentata* Hewson and a taxon she attributed to Ferdinand Mueller, var. *simplicifolia* F.Muell. These were recognised on the basis of just a few characters – the presence or absence of compound leaves, the number of leaflets (mostly 3-foliolate or mostly 4- and 5-foliolate), and the number of stamens (3 only, 4 only, or 4–7). Field observations show that other features, particularly the arrangement (not just the number) of stamens and the orientation and colour of the petals, also allow for the discrimination of entities which are, following Hewson, referable to *C. tetrandra*. Furthermore, additional collections of mature plants show that seed morphology – including ornamentation of the testa and the size and structure of the elaiosome – is also important in delimitating taxa currently referred to *C. tetrandra*.

Further work is required before some of these taxa can be formally described and named and the subject matter for this note is the taxon referred to by Hewson as *C. tetrandra* var. *simplicifolia* F.Muell. It is accepted here as a distinct species to which the name *C. linophylla* (O.Schwarz) Pax & K.Hoffmann applies. A description of the species is provided, a neotype is chosen, and the authorship of the taxonomic synonym, *C. tetrandra* var. *simplicifolia*, is discussed.

Taxonomy

Cleome linophylla (O.Schwarz) Pax & K.Hoffm., *Nat. Pflanzenfam.* 2nd ed., 17b: 212 (1936). *Triandrophora linophylla* O.Schwarz, *Rep. Spec. Nov. Reg. Veg.* 24: 85 (1927), basionym. Type citation: "Port Darwin, Rapid Creek, open forest (Bleeser no. 641).", not found. Neotype (here chosen): open, disturbed woodland on laterite adjacent to Leaning Tree Lagoon turn-off from Arnhem Highway, Northern Territory, 7 Jan. 2002, P.S. Short 5138 (DNA 172234). Isoneotypes: K, MEL.

Cleome tetrandra var. *simplicifolia* Hewson, *Fl. Australia* 8: 230 (1982), see note below. Type citation: "Darwin, Schultz; holo: MEL." Holotype: Port Darwin, [Frederick] Schultz 87, [1869 or 1870], (MEL 590948), see note below.

Annual herb with ascending to erect branches to c. 30 cm long, smallest plants erect and unbranched, stem and branches with a scattered but prominent indumentum of stalked, rigid glandular hairs. Leaves simple, linear, 2–40 mm long, 0.3–1.8 mm wide, shortly petiolate or the upper leaves sessile, with margins entire, apically weakly mucronate; petiole less than c. 1.3 mm long. Flowers c. 5–14 in a raceme. Sepals ovate to lanceolate, 0.8–1.3 mm long, 0.2–0.45 mm wide, mostly pale green, usually with a few glandular hairs. Petals oblanceolate and with no obvious claw, 3.2–4.9 mm long, with 2 petals held erect and 2 pointing down; upper petals shorter than the lower, at anthesis mainly yellow but each with an orange or reddish band towards the base and tending to be darker yellow beneath the band; lower petals at anthesis yellow throughout; all petals when in bud with dark pinkish or purplish apex, all mature petals commonly becoming white or pinkish- or purplish-white on drying and the band on the upper petals often not evident. Stamens usually 3, with two lateral stamens in the same plane and one curving down, sometimes with an additional upper stamen; filaments equal or somewhat unequal, 2.8–5.4 mm long, the lower $\frac{1}{3}$ – $\frac{1}{2}$ of the filament yellowish-green, the upper $\frac{1}{2}$ – $\frac{2}{3}$ of the filament reddish; anthers grey. Gynophore absent. Ovary sessile, glabrous, with a green c. 0.3 mm long fleshy protuberance (nectary?) between its base and the base of the upper petals. Capsules on glabrous pedicels 6–13 mm long, linear, subcylindrical, 13–19 mm long, c. 1.5 mm diam., held at less than 90° to the axis, with faint longitudinal striations, glabrous, with a beak 1.5–4 mm long. Seeds c. 7 per fruit, comma-shaped or suborbicular, 1.15–1.3 mm across longest axis, 0.9–1.2 mm across shortest axis, dark brown or orange-brown, cross-ribs distinct, concentric rings absent or very faint; elaiosomes present, small, one on each side of the funicle. Flowering & fruiting: Jan.–Feb. Fig. 1.

Distribution: Endemic to the Top End of the Northern Territory, Australia, ranging from the vicinity of Darwin east to Oenpelli and extending south to about Mataranka.

Habitat: *Cleome linophylla* grows on laterite gravel in open *Eucalyptus* and *Terminalia* woodland and is often noted on disturbed road verges, a fact suggesting that it may now be more widespread than it was prior to roadbuilding in the Top End.

Specific status: *Cleome tetrandra* DC. was described from a specimen in the Banks Herbarium, de Candolle noting that flowers have four stamens and that the leaves are 3-foliolate. *Cleome linophylla* is readily distinguished from typical *C. tetrandra* by having usually three, not four, stamens and by its simple leaves.

Petal arrangement was not noted by de Candolle but it is evident that *C. linophylla* is one of several taxa generally referred to the *C. tetrandra* complex with the four petals arranged in a cross, i.e. having two erect petals and two downward-pointing petals; other taxa in the complex have flowers with four erect petals. Of the taxa with a cross-

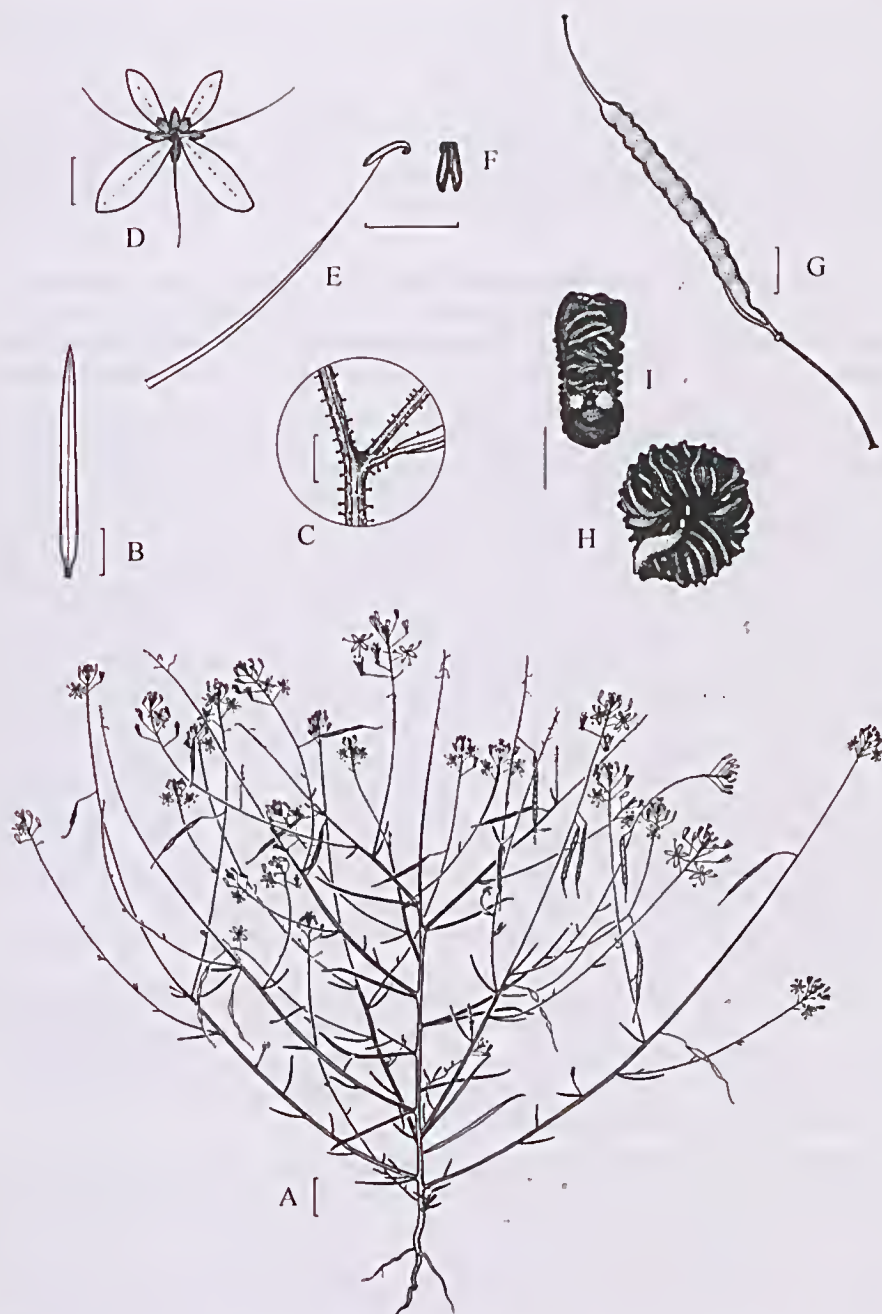


Figure 1. *Cleome linophylla*: A, habit; B, leaf; C, branchlets and leaf base showing stalked glandular hairs; D, illustration of flower drawn in the field, note that anthers have fallen; E, stamen; F, anther; G, fruit; H, side view of mature seed; I, mature seed showing elaiosomes on either side of the funicle. (A–D, G, H, from neotype. *Short 5138*; E, F, *Short 5136*). Scale bars: A = 1 cm, B = 5 mm, C, D, G = 2 mm, E, F, H, I = 1 mm.

shaped arrangement of petals, *C. linophylla* is the only one with simple leaves and commonly 3 stamens per flower. It is also one of only several taxa in the complex that produce a seed with two distinct elaiosomes.

Conservation Status: *Cleome linophylla* is not represented by many collections but field work indicates that numerous individuals may be present in populations. This fact, combined with its widespread habitat and liking for disturbed sites, suggests that following the IUCN Red List Categories Version 3.1 the species is one of "Least Concern".

Neotypification: The name *Triandrophora linophylla* was one of 43 new specific names applied by Schwarz (1927) to specimens collected in the Darwin region by F. A. K. Bleeser. McKee (1963) noted that the type specimens examined by Schwarz were incorporated in the Berlin Herbarium (B) and that all "seem to have been destroyed" (McKee 1963, p. 233) during World War II and that there was no record of any duplicates of Bleeser's specimens being distributed from B. He also noted that Bleeser himself kept, and may have distributed, duplicate specimens but that "Inquiries at the Arnold Arboretum, Kew, and several Australian herbaria ... failed to locate any substantial number of Bleeser duplicates" (McKee 1963, p. 233). However, McKee did list isotype specimens relevant to nine names established by Schwartz and which were incorporated in NSW in 1927. Subsequently, Willis (1966) noted that eight isotypes relevant to Schwartz's work had been received from Bleeser and incorporated in MEL in 1929, with four of these not represented in NSW. However, none of the specimens recorded by these authors to be in NSW and MEL was of *T. linophylla*. Furthermore, although Bleeser apparently retained a personal set of collections at his private residence in Darwin, Willis recorded that it was destroyed after Bleeser and his wife were evacuated from their Darwin home following the first Japanese bombing in February 1942. Bleeser died that same year in Adelaide, "heartbroken by the news that his carefully annotated specimens, zoological and botanical books and indexed photographic plates, the result of fifty years work, had been thrown out of his home by looters and trampled and destroyed in a day" (Lockwood 1992, p. 109).

Enquiries have reconfirmed the absence of any duplicate specimens of *Bleeser 641* at K, MEL and NSW.

Thanks to the detailed original description, and the apparent absence of any other taxon in the Darwin region with simple leaves and mostly three anthers, there can be no doubt as to the application of the name *T. linophylla*. Furthermore, there is no reason to believe that any original material is still extant. Accordingly, a neotype specimen, *Short 5138*, for the name *T. linophylla* has been chosen.

Authorship of C. tetrandra var. *simplicifolia*: Hewson (1982) recognised three varieties of *C. tetrandra* DC.: var. *tetrandra*, var. *simplicifolia* F.Muell. and var. *pentata* Hewson. When recognising the name var. *simplicifolia* F.Muell. she recorded that the holotype is in the National Herbarium of Victoria (MEL) and made a direct reference to the purported original publication by Mueller (1869). Chapman (1991), although including var. *simplicifolia* F.Muell. as a name in the *Australian Plant Name Index*, queried its status by noting "valid?" and by enclosing the entry in square brackets. However, it cannot be that the name was invalidly published by Mueller as he never proposed one. In following a note on *Helicteres spicata* with a list of additional species collected by Schultz from the Darwin region Mueller was doing nothing more than noting that Schultz's collection included a variant of *C. tetrandra* with simple leaves and three anthers, i.e. he recorded "...Clematis glycinoides Cand., Cleome viscosa L.,

Cleome tetrandra Banks var. *simplicifolia* triandra, *Polygala orbicularis* ...” (Mueller 1869, p. 40).

Although Mueller did not supply a name for the taxon he can be said to have provided a diagnosis to which Hewson made direct reference, while she also provided the name and specified the holotype. Article 41.3 of the *ICBN* (Greuter *et al.* 2002) allows valid publication by “reference to a previously and effectively published description or diagnosis of a species or infraspecific taxon” and with Mueller’s diagnosis being in Latin the requirement of Art. 36, that to be validly published on or after 1 January 1935 the name of a new taxon need only be accompanied by “reference to a previously and effectively published Latin description or diagnosis”, is also met. Similarly, the requirements of Art. 37.1, to indicate the type of the name, are met. It is therefore concluded that Hewson, unintentional though it was, validly published the name var. *simplicifolia*.

Type specimen of C. tetrandra var. *simplicifolia*: As noted in the original description the type specimen of the name var. *simplicifolia* was simply attributed to “Schultz”. Frederick Schultz and his son Alfred were members of George Goyder’s survey party of Darwin (c.g. Lockwood 1968). Undoubtedly both collected specimens but in both unpublished and published lists of specimens viewed by me all are simply attributed to Frederick and that procedure is followed here. As to the time of collection it is known that Goyder’s party landed in Darwin in late December 1868 and that Frederick Schultz was still resident in Darwin in February 1870 and seemingly to at least late May (Cavenagh 1870). I have also only noted this species flowering in January and February. Thus, available facts indicate that the type specimen was collected in the first couple of months of either 1869 or 1870.

The specimen consists of a single, very mature plant which is almost devoid of leaves and to which only remnants of fruit are attached. The leaves that remain, including some from near the base of the plant, are always unifoliate. Several flowers are held in an accompanying packet and match Mueller’s description in that there are only three stamens per flower. The packet also contains several fruit, or parts of fruit, which contain very immature seed. Due to their immaturity it is not clear whether the seed would have developed one or two elaiosomes. Despite it being a rather poor specimen, given my knowledge of the variation in the *C. tetrandra* complex in the Darwin region, I do not doubt that the name *C. tetrandra* var. *simplicifolia* is a synonym of *C. linophylla*, and here treat it as such.

Two handwritten labels accompany the holotype specimen at MEL. One is on lined paper and I do not know whether it is an original label. It simply reads “*Cleome tetrandra* Banks/ Port Darwin/ Schultz”. The other label has the printed heading “Phytologic Museum of Melbourne” and the handwritten notation “*Cleome*/ Port Darwin/ 87/ Schultz”. It is perhaps reasonable to assume that the number 87 is Schultz’s specimen number. However, if it is his number, then it is not unique to that collection. Many of Schultz’s specimens were sent by Richard Schomburgk to Kew for identification and the K library holds unpublished lists of instalments (or series) of the specimens which were received. There is no duplication of numbers on these lists and the list of the first instalment of specimens, communicated by Schomburgk in October 1869, shows *Schultz* 87 to be a specimen of a legume. However, aware that labels can be incorrectly attributed to specimens and, from the unpublished lists, that *Schultz* 213 and *Schultz* 286 held at K were determined as *C. tetrandra*, I arranged to view electronic images of both specimens to see if either matches the holotype at MEL. Indeed, that this needed to be done has since been verified by one of the referees who kindly noted that “The impression I have from seeing specimens from a number of

collectors, sent by Schomburgk to Kew, is that the numbers are not those of the collectors but may have been added by Schomburgk before despatch.”

Having examined the specimens it is clear that *Shultz 213* (K215249), although belonging to the *C. tetraandra* complex, has 3-fid, and perhaps even some 5-fid leaves and thus is not *C. linophylla*. The other specimen, *Schultz 286* (K215250) does look somewhat like the type specimen of var. *simplicifolia* at MEL, but unfortunately it is not clear from the image if one of the few leaves on the righthand side of the specimen is single or 3-foliate. Thus, I cannot definitely exclude the possibility that an isotype of var. *simplicifolia* exists at K but equally there is no compelling evidence that this is the case.

In the above discussion I have spelled the collector's surname as Schultz. I have opted to follow this spelling as it is that used on all specimens referred to herein, on the unpublished lists at K, on a published report of his specimens (Anon. 1870), and in the original publication of the name var. *simplicifolia*. However, the spellings “Schulze” (e.g. letter reproduced in Home 2002, p. 479) and especially “Schultze” (c.g. Cavenagh 1870, Lockwood 1968, Payne 1992, De La Rue 2004), all clearly referring to the same person, are also encountered in government documents of that time as well as in recent accounts of the early exploration and history of Darwin.

Specimens examined: Thorak Reserve, Shoal Bay, 7 Feb. 1979, *M.H. Andrew 327* (DNA); Ranger Uranium lease, Kakadu, 20 Mar. 1991, *K. Brennan 1198* (DNA); East Alligator River, 16 Feb. 1973, *C.R. Dunlop 3248* (DNA); c. 8 miles NE of Oenpelli Mission, 17 Feb. 1973, *M. Lazarides 7750* (DNA); 23 miles S of Darwin, 22 Feb. 1972, *J. Must 942* (DNA); Cannon Hill airstrip, 30 Jan. 1973, *P. Martensz AE610* (DNA); Koolpinyah Station, Howard River, on laterite, 14 Jan. 1997, *C. Michell 318* (DNA); 5 miles W of Stuart Hwy along road to Mandorah, 11 Jan. 1971, *J. Must 663* (DNA); Nitmiluk National Park, 19 Apr. 2001, *J.A. Risler 1621* (DNA); 8.6 km E of Corroboree Park, 7 Jan. 2002, *P.S. Short 5136* (DNA); adjacent to Leaning Tree Lagoon turn-off from Arnhem Highway, 7 Jan. 2002, *P.S. Short 5138* (DNA, neotype; K, MEL, isoneotypes); intersection of Central Arnhem Road and Stuart Highway, 11 Feb. 2004, *P.S. Short 5161* (DNA); 11.6 km S of Central Arnhem Road turnoff along Stuart Hwy, 12 Feb. 2004, *P.S. Short 5168* (DNA); 5 km NE of Howard River bridge, 17 Feb. 2005, *P.S. Short 5375* (DNA).

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Kathy De La Rue very kindly gave me access to her copies of early *South Australian Parliamentary Papers* and Goyder's diary, helping me to investigate the activities of Frederick Schultz.

I also thank both referees for comments on the original manuscript, particularly in reference to the Schultz collections and Schomburgk's possible numbering of specimens.

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A range extension for *Cryptandra pogonoloba* (Rhamnaceae: Pomaderreae) and recognition of a new subspecies

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Abstract

Additional herbarium specimens of *Cryptandra pogonoloba* A.R. Bean have revealed that the species is more widely distributed in Queensland than described in Bean (2004) and that the indumentum on the leaves can vary considerably. A new subspecies, *C. pogonoloba* subsp. *septentrionalis* Kellermann, is recognised for distinct populations from northern Cape York Peninsula and the description of the typical subspecies is amended.

Introduction

Bean (2004) published new species of *Cryptandra* Sm. from Queensland, among them *Cryptandra pogonoloba* A.R. Bean. He described the species as being unique by having long erect simple hairs at the apex of the calyx lobes, floral bracts with an aristate apex and stipules that are placed on the upper side of the petiole. Further distinctive characters mentioned by Bean include a dense indumentum of stellate trichomes on the adaxial surface of the leaves, a condition relatively rare in *Cryptandra*, the species of which usually have a glabrous, near glabrous or papillose upper surface.

The most distinctive character of the species is the light brown floral bracts; these are broadly ovate and have a very prominent reddish midrib, which extends into an awn that considerably exceeds beyond the lamina (up to 1 mm). The midrib of the stipules is similar. In contrast to Bean (2004), where the stipules are said to be placed on the upper side of the petioles, they are correctly described as overlapping behind the petiole, as well as being fused below the attachment point of the petiole – a feature characteristic for the genus *Cryptandra* (Thiele & West 2004).

For this study, more herbarium specimens of the species than used by Bean (2004) were available from AD, BRI, CANB, MEL and NSW. This has greatly increased our knowledge of the range of the species, which was previously thought to occur only in Bullringa National Park and surrounding areas (Bean 2004). *Cryptandra pogonoloba* extends from north-east of the Gregory Range to the Iron Range on northern Cape York Peninsula. It is one of the northernmost species of the genus. Examination of these specimens also revealed that the indumentum on the upper surface of the leaves of the species varies quite considerably.

While specimens from the type locality in Bullringa National Park have a dense, grey indumentum of stellate hairs, this is not the case for specimens collected from other localities. The indumentum varies from medium to dense and from single, erect hairs to stellate hairs. Some collections have very short, erect hairs or densely papillose surfaces with intermediates between these two forms. Similar variation within one species is also found in *C. tomentosa* Lindl., where there is a gradient from densely

pubescent to glabrous leaves, albeit that species has an indumentum of only simple hairs. Other species with densely pubescent upper leaf surfaces include *C. filiformis* A.R. Bean and *C. intratropica* W. Fitzg., but these species have a consistently dense indumentum.

Populations near Iron Range National Park and Paseoe River are smaller plants and have totally glabrous and smooth leaves, which are generally smaller than those of more southerly populations. They occur at lower altitude and are separated from the southern area of distribution by a gap of over 400 km. This contribution recognises this northern outlier as a distinct subspecies, *Cryptandra pogonoloba* subsp. *septentrionalis* Kellermann and amends the description of the typical subspecies with data from the additional herbarium material. Albeit geographically segregated from the typical subspecies, both taxa share unique diagnostic features that were already identified in the original description of Bean (2004), in particular the conspicuous awned bracts and stipules as well as the erect simple hairs at the apices of the sepals. It seems therefore appropriate to recognise the new taxon at subspecific level.

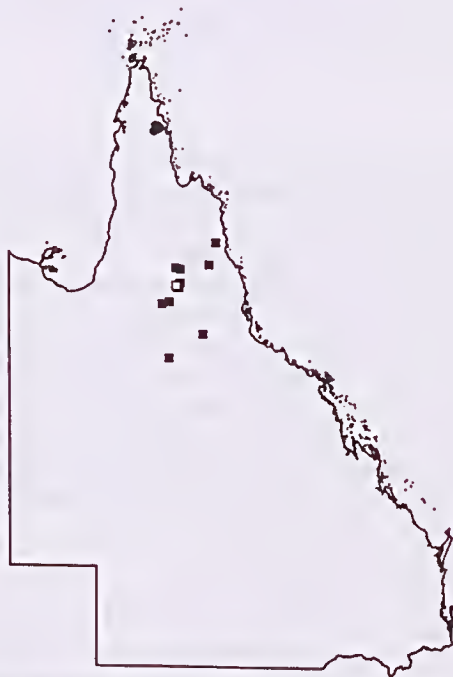


Figure 1. Distribution map of *Cryptandra pogonoloba* subsp. *pogonoloba* (squares) and subsp. *septentrionalis* (circles) in Queensland. A white square indicates the type locality of subsp. *pogonoloba* in Bulleringa National Park.

Taxonomy

Cryptandra pogonoloba A.R. Bean, *Austrobaileya* 6: 930 (2004). *Holotype*: Qld, Cook District, Bulleringa National Park, 80 km north-west of Mt Surprise, Red River area, 23 Apr. 1998, P.I Forster PIF22542 & R. Booth; BRI 605621. *Isotypes*: DNA *n.v.*, K *n.v.*, MEL 2263652, NSW *n.v.*, QRS *n.v.*

Shrubs 0.2–2 m high, not spinescent, with a dense grey or rusty indumentum of stellate and simple hairs on young stems, soon glabrous or persisting on older stems of current season's growth; leaves alternate or in fascicles. *Stipules* persistent, scarious, triangular or ovate, 1.2–2.3 mm long, attenuate or acicular, connate around the base of the petiole, overlapping behind petiole, sparsely to moderately pubescent on midrib and margin, or glabrous. *Petioles* 0.2–0.8 mm long. *Leaf blades* narrowly elliptic or linear with recurved or revolute margins, 2.3–9 mm long, 0.4–1.2 mm wide, entire; base obtuse; apex acute or apiculate with a dark mucro; lower surface usually not visible, densely grey-stellate-hairy, midrib visible or not visible, with sparse to moderate simple hairs; upper surface glabrous and smooth, or papillose or tuberculate, or covered with a moderate to dense indumentum of simple or stellate hairs. *Inflorescence* axillary, appearing terminal at tip of branchlets, consisting of 1–5 flowers in dense heads or clusters. *Bracts* 4–9, persistent, broadly ovate or obovate, 1–2.9 mm long, 1–1.9 mm wide, ciliate, awned, light brown; abaxial side sparsely to moderately pubescent on midrib or glabrous, adaxial side glabrous; cilia 0.3–0.6 mm long; awn protruding up to 1 mm beyond lamina. *Flowers* sessile or subsessile, white or cream. *Hypanthium tube* 0.6–0.8 mm long, 1.7–2.8 mm in diameter, covered with small dense stellate hairs. *Sepals* erect, 1–1.3 mm long, persistent on fruit, with an indumentum of small dense stellate hairs and long erect simple hairs towards apex. *Petals* erect, cucullate, 0.6–0.9 mm long, distinctly clawed, claw c. 0.2 mm long. *Stamen filaments* erect, 0.5–0.7 mm long. *Anthers* 0.3–0.4 mm long. *Disc* a sinuate ring, densely stellate-pubescent. *Ovary* inferior, 3-carpellate; summit densely stellate-hairy. *Style* 0.5–0.9 mm long, entire, glabrous. *Schizocarp* broadly obovoid, 1.8–2.4 mm long, dark brown, splitting into 3 dehiscent fruitlets; apex obtuse, torus in middle third or slightly higher. *Seeds* 1.1–1.4 mm long, reddish brown, ±uniformly coloured; *aril* pale yellow or pale orange, translucent.

Key to subspecies

- 1 Upper leaf surface with papillae or tubercles, or simple or stellate hairs; leaves (1.4–) 3–9 mm long, 0.5–1.2 mm wide, recurved or revolute; lower surface or at least midrib partly visible; flowers solitary or in clusters; between Mt Windsor and the Gregory Range, southern Cape York Peninsula subsp. *pogonoloba*
- 1: Upper leaf surface glabrous, smooth; leaves 2.3–4.5 mm long; 0.4–0.6 mm wide, strongly revolute; lower surface and midrib usually concealed; flowers always solitary; near Paseo River, northern Cape York Peninsula subsp. *septentrionalis*

Cryptandra pogonoloba subsp. *pogonoloba*

Illustration: A.R. Bean, *Austrobaileya* 6: 932 (2004), Fig. 7, photograph.

Shrubs 0.5–2 m high. *Petiole* (0.2–) 0.3–0.9 mm long. *Leaves* narrowly elliptic, (1.4–) 3–9 mm long, 0.5–1.2 mm wide, recurved or revolute; lower surface or at least midrib partly visible, upper leaf surface strongly papillate or tuberculate or covered with a medium to dense indumentum of simple and/or stellate hairs. *Bracts* and *stipules* glabrous or with hairs along the midrib. *Bracts* 1.4–1.9 mm wide. *Flowers* solitary or in clusters of up to 5 flowers especially at branch apices.

Distribution & habitat: The taxon grows in sandy soil on sandstone ridges and slopes in eucalypt woodlands. It occurs from Mt Windsor and Daintree National Park to the Gregory Range (Fig. 1) from 170–1200 m of altitude.

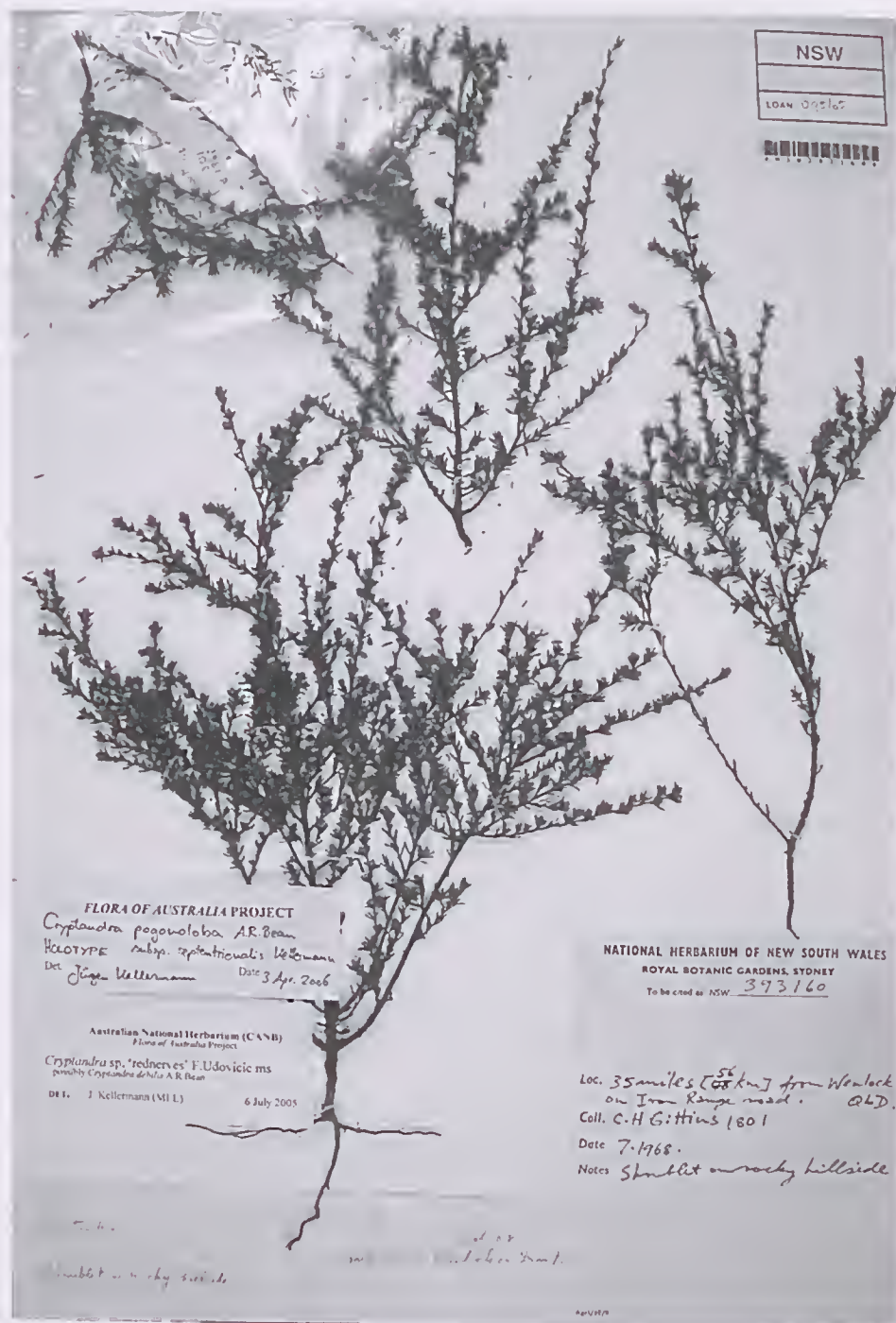


Figure 2. Holotype of *Cryptandra pogonoloba* subsp. *septentrionalis* Kellermann (C.H. Gittins 1801, NSW 393160).

Phenology: Flowers recorded in Jan. and Mar.–July, fruits Apr.–July.

Notes: The lower measurement for petiole and leaf length are due to one specimen from the southern end of distribution, *C. Kahler C530* & *C. Appelman*, which appears to be a small-leaved form. The leaves, however, are densely pubescent. Herbarium sheets seen and annotated by A.R. Bean are indicated with an asterisk in the following listing.

Specimens examined: **Queensland. Burke District.** Gregory Range, 120 km NE of Richmond, 27 km ENE of 'Middle Park' airstrip, 1 Apr. 2004, *C. Kahler G530* & *C. Appelman* (BRI*). **Cook District.** Etheridge River, *s.dat.* [before 1882], *W.E. Armit 658* (MEL); between Etheridge River and Einasleigh River, *s.dat.* [before 1882], *W.E. Armit 658* (MEL); Mt Windsor, Mar. 1941, *T. Carr 103* (BRI); Mt Windsor, 25 Mar. 1941, *T. Carr 166* (BRI); Mt Mulligan, 16 Apr. 1985, *J.R. Clarkson 5865* (BRI); 74 km along Bulimba Station Rd, 27 Jan. 1993, *P.I. Forster PIF13049* & *A.R. Bean* (BRI); Bulleringa National Park, 80 km NW of Mt Surprise, 24 Apr. 1998, *P.I. Forster PIF22608* & *R. Booth* (BRI*); Bulleringa National Park, 80 km NW of Mt Surprise, 25 Apr. 1998, *P.I. Forster PIF22642* & *R. Booth* (BRI*, MEL, DNA *n.v.*); Bulleringa National Park, 80 km NW of Mt Surprise, 26 Apr. 1998, *P.I. Forster PIF22689* & *R. Booth* (BRI*, DNA *n.v.*, MEL, CANB *n.v.*, NSW *n.v.*); 54 km along Bulimba Station road, off Chillagoe to Wrotham Park road, 1 June 1991, *P.I. Forster PIF8438* (BRI*, MEL, AD); Torwood Holding, N of Pinnaele Ck, *s.dat.*, *M.D. Godwin C3844* (BRI*).

Cryptandra pogonoloba subsp. *septentrionalis* Kellermann, subsp. nov.

A subspecies typica habitu minore, foliis brevioribus, lamina lineari et valde revoluta, superficie glabro laevique differt.

Holotype: Qld, Cook District, 35 miles [56 km] from Wenlock on Iron Range Rd, July 1968, *C.H. Gittins 1801*; NSW 393160 (Fig. 2). *Isotypes*: BRI AQ410452, CANB 359070.

Small shrubs 0.2–0.5 m high. *Petiole* 0.2–0.3 mm long. *Leaves* linear, 2.3–4.5 mm long, 0.4–0.6 mm wide, strongly revolute; lower surface and midrib usually concealed, upper leaf surface glabrous, smooth. *Bracts* and *stipules* always glabrous. *Bracts* 1–1.5 mm wide. *Flowers* always solitary.

Distribution & habitat: The subspecies occurs in heath and scrubland or open woodland with heathy understorey on sandy soil over laterite. Collections are only known from areas near Pascoe River, E of Sir William Thompson Range, and Iron Range National Park (Fig. 1). It is recorded from 60–120 m above sea level.

Phenology: Flowers recorded in July; fruits July–Sep.

Etymology: The epithet is derived from the Latin *septentrionalis* (northern) and alludes to the distinctly northern distribution of the subspecies.

Specimens examined: **Queensland. Cook District.** 12 miles E of 'The Lynd', 11 July 1954, *S.T. Blake 19465* (BRI, CANB); Brown's Creek, Pascoe River, 13 Jun. 1948, *L.J. Brass 19169* (BRI, CANB); Brown's Creek, Pascoe River, 13 July 1948, *L.J. Brass 19552* (BRI, CANB); 8.5 km N of Lockhardt River on the track to Wattle Hill, 8 Aug 1991, *J.R. Clarkson 9076* (BRI); 12.1 km NNE of Pascoe R on Iron Range Rd, 13 Sep. 1975, *R. Coveny 7091* & *P. Hind* (NSW); Between Browns Creek and Tozers Gap on Road to Iron Range, 9 July 1988, *M.B. Thomas 292* (BRI, DNA); road to Iron Range from Northern Development road, 27 July 1999, *N.G. Walsh 5759* & *J.P. Walsh* (MEL).

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A taxonomic treatment of tribe Senecioneae (Asteraceae) in Australia

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Abstract

A concise taxonomic treatment of the tribe Senecioneae (Asteraceae) in Australia is presented, with descriptions of 39 species from 13 of the 14 genera in the tribe in Australia (*Bedfordia* is excluded). Keys to all genera and to all species in the tribe are presented, including a key to all species of *Senecio* in Australia. Also for *Senecio*, a new, informal subgeneric classification is presented. Taxonomic changes presented include the recognition of *Senecio esleri* C.J.Webb as an earlier valid name for *S. brevityubulus* I.Thomps., the resurrection of *Senecio barkhausioides* Turcz., and the recognition of *Emilia fosbergii* Nicolson as a new alien species.

Introduction

The tribe Senecioneae in the Asteraceae comprises over 3000 species and is widely distributed in both hemispheres. In Australia the tribe is represented by 14 genera and 114 species. Ninety-six species are native, with 87 of these in *Senecio*, and 18 species are introduced. All but four of the native species are also endemic. *Senecio* is the only genus in the tribe in Australia containing both native and introduced species. Of the genera containing only native species, *Abrotanella* is represented by three native species, *Gymura* by one, *Arrhenechthites* by one, *Bedfordia* by three, and *Brachyglottis* by one. The last two of these genera are endemic. The remaining eight genera are represented by introduced species only. The native species *Senecio gregorii*, which in recent years has been included in the South African genus *Othomma*, is here included in *Senecio*.

The taxonomic review presented here is drawn from a *Flora of Australia* account of the Senecioneae recently prepared by the author. As it is likely to be several years before the *Flora* account is published, it is considered desirable to present the findings of my research at this time.

The Senecioneae are herbs, shrubs or small trees with distinctive involucre bract morphology. The inner bracts, termed phyllaries in this paper, form a single even-heighted series, and are neatly arranged side-by-side with their hyaline margins overlapping. An outer series (termed calycular bracteoles in this paper) is occasionally absent and otherwise is composed of conspicuously smaller and more loosely arranged parts. These bracteoles are more or less identical to the bracteoles commonly seen along peduncles. The achenes in members of the Senecioneae are commonly homomorphic or nearly so and the pappus is composed of fine, non-plumose bristles.

Although the genus *Bedfordia* was not included in the author's recent taxonomic research, a generic description, key to species and a list of taxa for the genus is presented below. For a detailed treatment of species the reader is referred to Orchard (2004). For *Senecio*, a new informal classification describing seven native groups is detailed herein. A complete key to species of Australian *Senecio* and descriptions of 22 of the 97 species are presented, including nine of the ten introduced species. The

remaining species are listed. For detailed accounts of these species, the reader is referred to recent papers by Thompson (2004a, 2004b, 2004c, 2004d, 2005a, 2005b).

Tribe SENECEAE

Herbs, shrubs or subshrubs, trees or climbers, sometimes dioecious or gynodioecious, taprooted or not; latex lacking. Hairs mostly eglandular, glandular in *Petasites* and *Bedfordia*, not furcate. Leaves mostly alternate, occasionally rosulate, pinnately or palmately veined, not spiny, glandular in *Abrotanella* and *Brachyglottis*. Inflorescences terminal, or axillary in *Bedfordia*. Capitula radiate, disciform or discoid, mostly pedunculate, sessile at first in *Abrotanella*; involucre comprising an even-heighted inner series of bracts (phyllaries); phyllaries free or rarely connate, without outgrowths; an outer series of bracts (calycular bracteoles*) present or not; receptacle epaleate, usually $\pm$ flat. Florets of radiate capitula: disc florets actinomorphic, bisexual**, or functionally male in *Petasites fragrans*; ray florets fewer than disc florets, zygomorphic, female, or pistillate but sterile in *Petasites fragrans*, with corolla-tube mostly glabrous; ligule commonly yellow, but also of other colours, with apex obtuse, 3-lobed. Florets of disciform capitula: central florets actinomorphic, bisexual, or functionally male sometimes in *Arrhenechthites*; outer florets actinomorphic, or zygomorphic in *Arrhenechthites*, female, mostly more numerous than central florets. Florets of discoid capitula all actinomorphic, bisexual. Anthers ecalcarate, ecaudate or caudate, with apical appendage ovate, lanceolate or oblong. Style in bisexual florets glabrous or with obtuse hairs; style-branches short to long, not tapering, often penicillate apically, occasionally with a tapering terminal appendage, commonly each with two stigmatic zones. Achenes homomorphic, sometimes mildly dimorphic in *Senecio*, terete, compressed in *Cineraria*, with ribs smooth, sometimes with papillose hairs, unbeaked or sometimes short-beaked in *Senecio*. Pappus homomorphic, absent in *Abrotanella*, white, pink in *Erechtites*; bristles uniform within a pappus, capillary, smooth, scabridulous or barbellate.

Notes: *Calycular bracteoles are significantly smaller and less regularly arranged than phyllaries. They arise proximal to the phyllaries, on or just proximal to the common receptacle, and form a variably crowded cluster or "calyx". They are more or less identical in form to the peduncular bracteoles which commonly occur along the peduncle.

**The terms female, male and bisexual for florets indicates the sexual structures present and their fertility, i.e. a female floret will have a pistil only and will be fertile. Functionally male indicates that both pistil and stamens are present, that viable pollen is produced, but that achenes do not develop.

Key to genera

- 1 Capitula radiate (ligules sometimes very small, never deeply and acutely lobed; ray florets fewer than disc florets)
 - 2 Largest leaves with a sharp division between petiole and lamina, with petiole > 5 cm long, and with lamina 1–1.5 times longer than wide, truncate to cordate
 - 3 Rosetted, dioecious herbs to 0.4 m high (plants male in Australia); ligules white..... **4. *Petasites***
 - 3 Hermaphrodite shrubs to 3 m high; ligules yellow **5. *Roldana***
 - 2: Largest leaves not as above or if so then petiole < 5 cm long, and with

lamina > 2 times longer than wide, attenuate to cuneate

- 4 Capitula solitary on a long, naked peduncle densely woolly at base, ecalyculate; phyllaries connate proximally **7. *Euryops***
- 4: Capitula solitary or not, peduncle various, not densely woolly at base, mostly calyculate; phyllaries free, or if fused then leaves not dissected.
 - 5 Trees to 3.5 m high; leaves viscid, upper surface gland-dotted **2. *Brachyglottis***
 - 5: Herbs to 2.5 m high; leaves not viscid or gland-dotted.
 - 6 Achenes compressed, winged **8. *Cineraria***
 - 6: Achenes $\pm$ terete, not winged **9. *Senecio***
- 1: Capitula discoid or disciform (if outer florets rarely bearing a ligule c. 1 mm long, then ligule deeply and acutely lobed and outer female florets more numerous than the bisexual central florets)
 - 7 Plants climbing; petiolate, with reniform auricles at base of petiole; lamina of approximately equal length to petiole; lamina about as broad as long, strongly cordate **6. *Delairea***
 - 7: Plants not climbing; not petiolate or if so then petiole much shorter than lamina and without reniform auricles at base; lamina longer than wide, with base variously shaped
 - 8 Inflorescences axillary; lower surface of leaves, peduncles and capitula densely woolly; capitula discoid; shrubs or trees; leaves entire **3. *Bedfordia***
 - 8: Inflorescences terminal; lower surface of leaves, peduncles and capitula usually not all at once densely woolly, or if so then plants herbaceous with capitula disciform; capitula discoid or disciform; herbs or shrubs; leaves entire or variously divided or toothed
 - 9 Capitula ecalyculate
 - 10 Plants generally < 10 cm high, often forming cushions; leaves to 5 mm wide; capitula disciform with involucre 1–4 mm long; pappus absent (south of latitude 36° S, montane to alpine) **1. *Abrotanella***
 - 10: Plants generally > 10 cm high, not forming cushions; largest leaves more than 5 mm wide; capitula discoid with involucre 7–12 mm long; pappus present (north of latitude 30° S, lower than montane) **13. *Emilia***
 - 9: Capitula calyculate
 - 11 Calycular bracteoles narrow-linear with l:w ratio > 10, 0.1–0.2 mm wide; receptacular pits all raised; style-branches purple distally
 - 12 Leaves undivided, or if pinnatisect then segments not present beyond mid-leaf; capitular buds pendent; capitula discoid; corolla-lobes orange or red; achenes purple; pappus white **11. *Crassocephalum***
 - 12: Leaves pinnatisect with segments beyond mid-leaf; capitular buds erect, capitula disciform; corolla-lobes pink; achenes pale brown; pappus pink **10. *Erechtites***

- 11 Calycular bracteoles variously shaped with l:w ratio < 10, or if ever more then c. 0.4–0.8 mm wide; receptacular pits not or hardly raised; style-branches yellow
 - 13 Herbs; capitula discoid; style-branches terminating with a tapering, hairy appendage; achenes > 5 mm long.....14. *Gyuura*
 - 13: Herbs or shrubs; capitula disciform or discoid; style-branches without a tapering hairy appendage; achenes < 5 mm long or if > 5 mm long then capitula disciform
 - 14 Involucre 12–20 mm long and length 5–7 times that of diameter (mid-involucre unpressed); capitula disciform with outer florets bearing a rudimentarylacerately lobed ligule c. 1 mm long; central florets 2–5 12. *Arrheneclithites*
 - 14: Involucre shorter and/or less slender than above; capitula discoid or if disciform then with outer florets without a ligule; bisexual central florets mostly more 5 9. *Senecio*

1. *Abrotanella* (Gaudich.) Cass., *Diet. Sci. Nat.* 36: 27 (1825)

Perennial herbs. Leaves sessile, with sunken glands, with venation obscure. Capitula disciform, sessile or sub-sessile at anthesis, but sometimes subsequently developing a peduncle, ecalyculate; phyllaries free. Florets: central florets sometimes functionally male (all Australian species); corolla-limb variously coloured. Anthers caudate. Style undivided (functionally male florets) or shortly branched, with apex truncate, crowned by papillae if functional, without terminal appendage. Achenes homomorphic, obovoid. Pappus absent.

A genus of 18 species predominantly of subantarctic distribution from southern South America, New Zealand, New Guinea, and Australia. Three species in Australia. Its tribal placement is problematic; it was placed in the Anthemideae until transferred to subtribe Blennospermatinae of the Senecioneae by Nordenstam (1977). Several molecular studies, e.g. Wagstaff & Breitwieser (2002) and Pelter *et al.* (2002), have not clarified its phylogenetic position. The Australian species of *Abrotanella* have functionally-male central florets. Other features of this genus not seen in other senecionoid genera in Australia include the loose and irregular overlapping and uniform shape of the phyllaries, and the poor differentiation of the corolla into basal cone, tube and limb regions.

Key to species

- 1 Inflorescences of 2 or more capitula.....3. *A. scapigera*
- 1: Inflorescences of 1 capitulum
 - 2 Plants forming dense cushions, with stems closely packed; leaves sub-erect, lanceolate, 3–8 mm long, with apex acute 1. *A. forsteroides*
 - 2: Plant habit not as above; leaves somewhat spreading, linear, 8–20 mm long, with apex ± rounded 2. *A. nivigera*

1. *Abrotanella forsteroides* (Hook.f.) Benth., Fl. Austral. 3: 554 (1867), as *forsterioides* *Scleroleima forsteroides* Hook.f., in W.J.Hooker, *London J. Bot.* 5: 444, t. 14 (1846).

Type: Tasmania, 1839–43, *J.D.Hooker Antarct. Exp.*; lecto: K, *fide* U.Swenson, *Pl. Syst. Evol.* 197: 161 (1995).

Cushion-plants to 7 cm high, $\pm$ glabrous, with adventitious roots c. 1 mm diam. Leaves suberect, ovate to lanceolate, 3–8 mm long, convex abaxially; base dilated; margin entire or denticulate; apex acuminate, mucronate. Capitula 1 per stem; peduncle to c. 8 mm long at maturity, with bracteoles lacking; involucre c. 1 mm long; phyllaries 3–7, c. oblong, finally erect; sterome flat, thin, without resin ducts. Florets: outer florets 1–3; central florets 1–3; corolla 2.0–2.5 mm long; limb greenish-yellow, 4-lobed. Achenes obovoid, 1.5–1.8 mm long, slightly to markedly 4-ribbed, brown, glabrous.

Notes: Occurs in north-western, north-eastern and south-central Tasmania. Grows in summit moors, screes and wet places such as below snowbanks at altitudes over 1000 m. Flowers mid-spring–summer

Grows with other cushion plants in alpine communities forming cushions to several metres in diameter. The stems and leaves are closely crowded with older leaves brown and persistent. The involucre is hidden within upper leaves at anthesis but is exposed at fruiting. Unlike the other two species in Australia, the one or two achenes in each capitulum strongly exceed the involucre at maturity.

Representative specimens: TASMANIA: Ben Lomond National Park, Hamilton Crags, 1.5 km east of Legges Tor, *F.E.Davies 1182*, *P.Ollerenshaw*, & *R.Burns* (AD, CANB, HO, MEL); 0.5 km NW of Second Bar L., *A.Moscal 6949* (HO).

2. *Abrotanella nivigena* (F.Muell.) F.Muell., *Pl. Victoria* 2: t. 40 (1865).

Trineuron nivigenum F.Muell., *Trans. Philos. Soc. Victoria* 1: 105 (1855).

Type: Munyang Mtns, New South Wales, Jan. 1855, *F.Mueller*; lecto: MEL, *fide* U.Swenson *op. cit.* 172; isolecto: MEL.

Cushion-plants to 3 (–5) cm high, largely glabrous, with adventitious roots c. 0.5 mm diam. Leaves somewhat spreading, narrow oblong to linear, 8–20 mm long, $\pm$ flat; base slightly dilated; margin entire; apex $\pm$ rounded to truncate. Capitula 1 per stem; peduncle 5–20 mm long at maturity, with bracteoles present; involucre 2.5–4.0 mm long; phyllaries 8–14 (–16), c. oblong, finally erect; sterome flat, fleshy, with 1 or 3 longitudinal ducts. Outer florets 7–17; central florets 4–12; corolla 1.5–3 mm long; limb white or purple, 3- or 4-lobed. Achenes obovoid, 2 mm long, slightly to markedly 4-ribbed, pale but purple distally, glabrous. *Snow-wort*.

Notes: Occurs in the Kosciuszko region of south-eastern New South Wales and in eastern Victoria. Grows in alpine bogs, herbfields, grasslands, in rock crevices, and often associated with small waterfalls. Flowers summer.

Abrotanella papuana S.Moore resembles *A. nivigena* and was regarded as synonymous by Swenson (1995); however, it differs in several ways. *Abrotanella papuana* lacks 3-lobed central florets, has fewer outer florets, sometimes has hairs on peduncles and has leaves that are more erect. Additionally, leaves are more tapered distally, with an apex subacute to obtuse, with scattered translucent multicellular hairs

on upper surface of leaves especially near margins; peduncular bracts are fewer (1–4); and the involucre shorter (2.5–3 mm long).

Representative specimens: NEW SOUTH WALES: Snowy R. near bridge below Seaman's Hut, Koseiuzsko area, *M.Gray 6611* & *C.Totterdell* (CANB, MEL, NSW); Below Mt Stillwell, Koseiuzsko area, *A.B.Costin 36* (CANB). VICTORIA: Southern head of Big R., c.1.6 km east of Spion Kopje summit, Bogong High Plains, 3 Feb. 1949, *J.H.Willis* (MEL).

3. *Abrotanella scapigera* (F.Muell.) Benth., *Fl. Austral.* 3: 554 (1867)

Trinenron scapigerum F.Muell., *Hooker's J. Bot. Kew Gard. Misc.* 9: 301 (1857).

Type: Mt La Perouse, Tasmania, *C.Stuart*; lecto: K, *fide* U.Svenson, *op. cit.* 169 (1995).

Tufted scapiform herbs to 10 cm high, with brownish hairs on scape and leaf-margins, with adventitious roots mostly 0.3–0.5 mm diam. Leaves suberect, narrow spatulate or very narrow-elliptic, 10–40 mm long, $\pm$ flat or convex abaxially; base slightly dilated; margin entire; apex obtuse to acute, mucronate. Capitula 2–10 per stem; peduncle to c. 15 mm long at maturity, with bracteoles present; involucre c. 3.0–3.5 mm long; phyllaries 8–12 (–14), c. oblong, finally erect; stereome flat, fleshy, with 3 longitudinal ducts. Female florets 8–17; male florets 3–11; corolla 1–2 mm long; limb white, 4 (–5)-lobed. Achenes obovoid, 1.7–2.2 mm long, slightly to markedly 4-ribbed, brown, glabrous.

Notes: Occurs in north-western and south-central Tasmania. Grows in moist low alpine grasslands, amongst cushion plants, sometimes in the shelter of low shrubs and in rock crevices, altitudes over 950 m. Flowers summer.

The flowering stem of this species has one or a few bracteal leaves, an unusual feature in *Abrotanella*.

Representative specimens: TASMANIA: Eldon Bluff, *A.M.Buchanan 9993* (HO); Between L. Dobson and summit of Mt Field, *D.N.McVean 22* (CANB); Mt Field National Park, Naturalist Peak, *P.S.Short 3427*, *A.Griffen*, *M.C.Looker* & *N.G.Walsh* (MEL).

2. *Brachyglottis* J.R.Forst. & G.Forst., *Char. Gen. Pl.* 91, t. 46 (1775).

Trees (in Australia), shrubs, lianes, or perennial herbs. Leaves petiolate or sessile, sometimes with glands, pinnately veined. Capitula radiate (in Australia) or disciform, pedunculate, calyculate (in Australia) or not; phyllaries free. Florets: corolla-limbs yellow, creamy white or white. Anthers caudate or not. Style-branches with apex obtuse to truncate, crowned by papillae, without terminal appendage. Achenes homomorphic, obloid to obovoid. Pappus $\pm$ persistent.

A genus of 29 species, all from New Zealand and the Chatham Is. except for one species endemic to Australia. The Australian representative, *B. brunonis*, was transferred to *Brachyglottis* by R.B.Nordenstam, *op. cit.* 25; however, the author acknowledged the unique suite of features of this species and gave consideration to reinstating it in *Centropappus*. Molecular studies by Wagstaff & Breitwieser (2004) have indicated that *Brachyglottis brunonis* and *Bedfordia* together form a monophyletic group, and that this group is nested within a large clade containing New Zealand species of *Brachyglottis* as well as several other genera endemic to New Zealand. Their suggestion for a revised classification based on the molecular evidence is to place all taxa in this clade in the genus *Brachyglottis*. In contrast, Orchard (2004) indicated that *Bedfordia* and *Brachyglottis brunonis*, although probably closely related, were

sufficiently different morphologically to be separated at a generic level, and suggested, contingent on further molecular proof, that *B. brunonis* be returned to *Centropappus*.

Brachyglottis brunonis (Hook.f.) B.Nord., *Opera Bot.* 44: 30 (1978)

Centropappus brunonis Hook.f., in W.J.Hooker, *London J. Bot.* 6: 124 (1847); *Senecio brunonis* (Hook.f.) J.H.Willis, *Muelleria* 1(3): 162 (1967).

Type: Mt Wellington, Tasmania, *R.C.Gunn s.n.*; holo: K *u.v.*, *fide* R.B.Nordenstam *loc. cit.*

Senecio centropappus F.Muell., *Catalogue of Plants under Cultivation in the Melbourne Botanic Gardens* 26 (1858), *nom. illeg.* Type: not designated.

Small trees to 3.5 m high, glabrous, with dark, laminating bark. Leaves crowded, narrow-linear, 5–10 cm long, entire, viscid, upper surface gland-dotted. Capitula many per stem; peduncle to c. 15 mm long at maturity; calycular bracteoles 3–5, ovate, c. 2 mm long; involucre 3–5 mm long, c. 3 mm diam.; phyllaries 8, oblong-elliptic to narrow-oblong-elliptic, fimbriate distally; stereome convex, with 1–3 resin ducts; margin of receptacular pits slightly raised. Florets: ray florets 5; ligules c. 5 mm long, 5–8-veined, yellow; disc florets c. 15–20; corolla exceeding phyllaries by c. 2 mm, c. 4–5 mm long; base c. 0.6 mm diam.; limb c. 2/5 of total length, with lobes narrow-oblong, revolute. Achenes slightly obovoid, 2.5–3 mm long, 5–8-ribbed, pale brown, glabrous; basal annulus narrow. Pappus c. 4 mm long, white; bristles scabrid-barbellate to sub-plumose. *Tree Ragwort*.

Notes: Occurs in south-eastern Tasmania where restricted to Mt Wellington and Mt Dromedary. Grows on dolomite, on moderate to steep slopes, in tall open forest at altitudes from 490–1160 m. Flowers summer.

A distinctive species, but similar in several ways including involucre morphology to *Bedfordia* and to a lesser extent *Abrotanella*, although the latter is a dwarf herb. Leaves when crushed and flowers are pleasantly fragrant suggestive of apricots according to one collector.

Representative specimens: TASMANIA: Mt Wellington, Pinnacle Rd, c. 3 km from summit at start of Organ Pipes track, *F.E.Davies* 780 & *P.Ollerenshaw* (AD, CANB, HO, MEL); c. 2 km below Mt Wellington summit on Mt Wellington Rd (c. 19 km south by Rd from Hobart), *P.C.Jobson* 1901, *N.G.Walsh* & *I.R.Telford* (BRI, HO, MEL).

3. *Bedfordia* DC., in A.-J.Guillemin, *Arch. Bot.* 2: 332 (1833)

Small trees or shrubs, with a dense wool on most younger parts. Leaves shortly petiolate, with glandular hairs on newer growth, pinnately veined. Capitula discoid, pedunculate, calyculate; phyllaries free. Florets: corolla-limbs orange, yellow, or creamy white. Anthers caudate. Style-branches with apex obtuse to truncate, crowned by papillae, without terminal appendage. Achenes homomorphic, c. obloid. Pappus ± persistent.

The species in this genus are closely related to *Brachyglottis brunonis* *q.v.* but readily distinguished from the latter and other senecionoid species in Australia by the woolly indumentum covering branches, abaxial surfaces of leaves, peduncles and involucre. The calyculus is weakly developed and is usually represented by only a few linear or lanceolate bracteoles.

A genus of three species endemic to south-eastern Australia. This genus was not included in the author's examination of the ScneCIONEAE. The reader is referred to a recent revision by Orchard (2004).

Key to species

- 1 Leaves to 3 mm wide (Tasmania)..... **1. *B. linearis***
- 1: Leaves generally more than 10 mm wide
 - 2 Leaves generally less than 20 mm wide; lower surface of leaves with a shallow appressed indumentum from which secondary veins conspicuously protrude (Tasmania)..... **2. *B. salicina***
 - 2: Leaves generally more than 20 mm wide; lower surface of leaves with a deep tangled indumentum in which the secondary veins are submerged (mainland Australia and Cape Barren Is., Tasmania) **3. *B. arborescens***

List of taxa

1. *Bedfordia linearis* (Labill.) DC., *Prodr.* 6: 441 (1838)
 - a. *Bedfordia linearis* subsp. *linearis*
 - b. *Bedfordia linearis* subsp. *oblongifolia* Orchard, *Muelleria* 19: 90 (2004)
 - i. *Bedfordia linearis* subsp. *oblongifolia* var. *oblongifolia*
 - ii. *Bedfordia linearis* subsp. *oblongifolia* var. *curvifolia* Orchard, *Muelleria* 19: 93 (2004).
2. *Bedfordia salicina* (Labill.) DC., *Prodr.* 6: 441 (1838).
3. *Bedfordia arborescens* Hochr., *Candollea* 5: 332 (1934).

4. *Petasites* Mill., *Gard. Dict. Abr.* 4th edn (1754).

Perennial dioecious or gynodioecious herbs. Leaves petiolate, palmately veined. Capitula radiate (in Australia) discoid or disciform, pedunculate, calyculate; phyllaries free. Florets: corolla-limbs yellow, white, greenish, pink or purple. Anthers caudate. Style-branches short, with apex obtuse, with terminal appendage unknown. Achenes homomorphic, narrow-obloid, ribbed. Pappus persistence not known.

A genus of c. 19 species from Eurasia and North America.

**Petasites fragrans* (Vill.) C.Presl, *Fl. Sicul.* 1: 28 (1826)

Tussilago fragrans Vill., *Actes Soc. Hist. Nat. Paris* 1: 72 (1792).

Type: *n.v.*

Dioecious, rhizomatous herbs to c. 0.4 m high, with glandular hairs on most parts. Basal leaves: petiole 10–30 cm long, sheathing basally; lamina suborbicular to reniform, 5–20 cm long; base strongly cordate; margin crowded-denticulate. Stem leaves 2–7, c. 2–6 cm long, comprising a well-developed sheath and a small lamina reducing to vestigial upwards. Capitula several per stem; peduncle to c. 30 mm long at maturity; calycular bracteoles 2–6, $\pm$ linear, 3–8 mm long; involucre 7–12 mm long, c. 3–6 mm diam.; phyllaries c. 13; stereome flat. Capitula (for all Australian material): ray florets c. 12, pistillate but sterile; ligule 4–6 mm long, rounded to truncate, white, sometimes tinged purplish, 3–5-veined; disc florets c. 20, functionally male; corolla c. 8 mm long,

with base c. 0.5 mm diam.; limb c. 2/5 of total length, white, with narrow-oblong lobes. Achenes obloid, 1.5–2.0 mm long. Pappus 4–8 mm long, white; bristles scabrid-barbellate. *Winter Heliotrope*.

Notes: Native to northern Africa. Occurs in south-central Victoria and in south-eastern Tasmania. Grows in damp shady places such as roadside ditches. Flowers winter.

Plants recorded in Australia have all been functionally male. Spreads vegetatively from disturbed sites into bushland. Flowers are vanilla-scented. The dark purple anther-tube of disc florets contrasts with the white corolla and strongly protruding stigma.

Representative specimens: VICTORIA: On the northern side of the railway line, c. 100 m west of Upper Ferntree Gully Railway Station, *D.E. Albrecht 1856* (MEL). TASMANIA: Recreation area of Huon Hwy, Franklin, *D.I. Morris 8255* (HO).

5. *Roldana* La Llave, in P. de La Llave & J.J.M. de Lexarza, *Nov. Veg. Descr.* 2: 10 (1825)

Herbs, shrubs or small trees. Leaves petiolate, palmately (in Australia) or pinnately veined. Capitula radiate (in Australia), discoid or disciform, pedunculate, calyculate or not; phyllaries free. Florets: ligule yellow (in Australia), orange, white or greenish; disc florets with corolla-limbs yellow (in Australia). Anthers caudate. Style-branches linear, with apex truncate, without terminal appendage. Achenes homomorphic, obloid to obovoid. Pappus caducous.

A genus of c. 55 species predominantly from Mexico and Central America.

**Roldana petasitis* (Sims) H. Rob. & Brettell, *Phytologia* 27: 423 (1974)

Cineraria petasitis Sims, *Bot. Mag.*, t. 1536 (1813); *Senecio petasitis* (Sims) DC., *Prodr.* 6: 431 (1838).

Type: cultivated, not designated.

Shrubs to c. 3 m high, with short coarse hairs on all parts. Leaves: petiole 5–15 cm long; lamina sub-orbicular to broad-ovate, 8–15 cm long; base cordate; margin finely denticulate. Capitula many per branch; peduncle to 20 mm long at maturity; calycular bractcoles 1–3, linear, 1–5 mm long; involucre 9–11 mm long, 3–5 mm diam.; phyllaries c. 8; stereome flat. Florets: ray florets 3–6; ligule 6–10 mm long, 4- or 5-veined, yellow; disc florets 10–15; corolla c. 8 mm long, with base c. 0.8 mm diam., with limb c. 2/3 of total length, with narrow-triangular lobes. Achenes obloid, 2.5–4.5 mm long, yellowish, 10-ribbed, glabrous. Pappus 7–10 mm long, white; bristles scabrid-barbellate. *Roldana*.

Notes: Native to Central America. Recorded from northern and central coastal areas of New South Wales and south-central Victoria. A garden escape preferring moister environments. Flowers mainly spring.

A widely-cultivated tall shrub characterised by an even, short pubescence, large, petiolate leaves, and purple stems, peduncles and phyllaries.

Representative specimens: NEW SOUTH WALES: North Coast, Forbes Forest Rd, Mt Boss State Forest, *P. Gilmour 5848* (CANB). VICTORIA: Dollar, c. 1.5 km south of township on the Dollar–Gippsland Hwy Rd, Nov. 1995, *S. Kaiser s.n.* (MEL).

6. *Delairea* Lem., *Ann. Sci. Nat. Bot.* ser. 3, 1: 379 (1844)

Climbing perennials. Leaves petiolate, palmately veined, auriculate. Capitula discoid, pedunculate, calyculate; phyllaries free. Florets: corolla-limbs yellow. Anthers caudate. Style-branches with apex truncate, crowned with papillac, without terminal appendage. Achenes homomorphic, obloid. Pappus caducous.

A monotypic genus native to South Africa. The only member of tribe Senecioneae in Australia to have auricles developed at the base of petiolate leaves. Similar in habit and leaf form to climbing species of *Senecio*, but readily differentiated by the presence of auricles and the discoid capitula.

****Delairea odorata* Lem., *Ann. Sci. Nat. Bot.* ser. 3, 1: 380 (1844)**

Senecio nikanioides Otto ex Walp., in C.F.Otto & A.Dietrich, *Allg. Gartenzeitung* 13: 42 (1845).

Type: cult., not designated.

Senecio scandens DC., *Prodr.* 6: 404 (1838), *nom. illeg. non* D.Don (1825), *p.p.*
Type: South Africa [several syntypes]: *n.v.*

Climbers to c. 3 m high, $\pm$ glabrous. Leaves: petiole 4–7 cm long; lamina to c. 8 cm long, broad-ovate to rotund, lobate; base deeply cordate; margin entire. Capitula many per branch; peduncle to c. 10 mm long at maturity; calycular bractcoles 2–4, narrow-oblong to oblanceolate, 2–3 mm long; involucre 3–4 mm long, c. 2 mm diam.; phyllaries 7–10; stereome flat or slightly ridged proximally, thin, with 1 (–2) ducts; margin of receptacular pits raised. Florets c. 10–12; corolla exceeding involucre by 3–4 mm, c. 5 mm long; base c. 0.5 mm diam.; limb c. 2/5 of total length. Achenes obloid, c. 2 mm long, pale brown, prominently 10-ribbed, glabrous or with hairs sparse. Pappus 5–6 mm long, white; bristles minutely scabrid-barbellate. *Ivy Groundsel*, *Cape Ivy*.

Notes: Occurs in south-eastern Australia from Kempsey in north-eastern New South Wales south to eastern Victoria and from there west across southern Victoria to Adelaide and Robe in south-eastern South Australia; also in Tasmania. Grows in sandy soils in forest and heathland. Flowers winter.

The inflorescences of *D. odorata* are densely corymbiform. It is vegetatively similar to the three introduced climbing species of *Senecio* in Australia *Senecio angulatus*, *S. tamoides* and *S. macroglossus*, but its leaves have prominent reniform auricles and a more strongly cordate lamina.

Representative specimens: SOUTH AUSTRALIA: Mt Lofty Ra., Gorge Rd, opposite Trout Nursery Dam, *N.N.Donner* 754 (AD, MEL). NEW SOUTH WALES: Alongside Macleay R., about 1 km from Kinchela towards Jerseyville, *J.R.Hosking* 1714, *G.R.Hosking* & *T.L.Hosking* (CANB, MEL, NE, NSW); Lower slopes of Mt Dromedary, c. 1 km west of Tilba Tilba, *P.C.Jobson* 4696 (BRI, NSW). VICTORIA: Labertouche Rd c. 70 m south of Tarago R., c. 2 km NE of Longwarry North, *I.C.Clark* 2691, *L.Dean* & *P.Dourmis* (AD, CANB, MEL). TASMANIA: Taroona, near Hobart, July 1947, *W.M.Curtis* (AD, HO, MEL).

7. *Euryops* (Cass.) Cass., *Dict. Sci. Nat.* 16: 49 (1820).

Shrubs or subshrubs, rarely herbs. Leaves sessile, pinnately veined. Capitula radiate (in Australia) or rarely discoid, pedunculate, ecalyculate; phyllaries often connate proximally. Florets: ligule yellow; disc florets rarely functionally male; corolla-lobes yellow or orange. Anthers ecaudate. Style-branches flattened to sub-terete, with apex

truncate, often crowned by papillae, without terminal appendage. Achenes homomorphic, obloid. Pappus caducous or absent.

An entirely African genus of c. 97 species, with most species in southern Africa. Part of the othonnoid complex of genera (as described by Jeffrey in 1986). The large capitula, long naked peduncles and the presence of wool at the base of the peduncle are distinctive features of the genus. Some capitula arise from very short branches and plants will therefore appear to have inflorescences with multiple capitula. *Euryops pectinatus* is a widely grown garden shrub with grey-green pectinately-lobed leaves. There is no evidence that it has become naturalised.

Key to species

- Leaves deeply pinnatisect, with segments linear; phyllaries connate in proximal 1/3–1/2; pappus forming a tangled wool **1. *E. abrotanifolius***
- Leaves lobate to subpinnatisect, with segments triangular; phyllaries connate in proximal 1/5 to 1/4; pappus absent **2. *E. chrysanthemoides***

1. **Euryops abrotanifolius* (L.) DC., *Prodr.* 6: 443 (1838)

Othonna abrotanifolia L., *Sp. Pl.* 2: 926 (1753).

Type: Locality unknown, Herb. Linn. 1038:5; lecto: LINN, *fide* B.Nordenstam, *Opera Bot.* 20: 272 (1968).

Shrubs to c. 2 m high, largely glabrous. Leaves 2–6 cm long, pinnatisect, with rachis and segments narrow-linear; base narrow; margin entire. Capitula 1 per branch but often with a few branches clustered; peduncle to c. 200 mm long; involucre 8–11 mm long, c. 8–10 mm diam.; phyllaries c. 13, sometimes more, fused in proximal 1/3–1/2; stereome $\pm$ flat, firm, with 3–5 distinct resin ducts; margin of receptacular pits raised. Ray florets c. 13, sometimes more; ligule to 25 mm long, commonly c. 7-veined; disc florets numerous; corolla c. 4 mm long; with base c. 1 mm diam.; limb c. 1/2 of total length, with narrow-triangular lobes. Achenes oblong-ellipsoid, c. 2.5–5 mm long, pale brown, 10-ribbed, glabrous, with stylophore appended distally. Pappus white; bristles tangled, some reflexed, 3–6 mm long, scabrid-barbellate. *Winter Euryops*, *Euryops*.

Notes: Occurs in the Mount Lofty Ra. in south-eastern South Australia, Heywood in south-western Victoria, the eastern fringe of Melbourne in south-central Victoria, and around Hobart in south-eastern Tasmania. Grows in areas recently disturbed such as roadsides, railway cuttings etc., in grassland and forest. Flowers winter–early spring.

A garden escape that is well-established in a few areas and capable of increasing numbers rapidly. The stylophore and tangled pappus do not occur in other species of Senecioneae in Australia.

Representative specimens: SOUTH AUSTRALIA: Mt Lofty Ra., Forest Ra., c. 20 km east of Adelaide, *H. van Dam* 194 (AD). VICTORIA: 2.3 km east along the Lilydale–Monbulk Rd from its intersection with the Lilydale–Montrose Rd, Mt Evelyn, *D.E. Albrecht* 2840 (CANB, MEL). TASMANIA: Mt Stuart, Hobart, *A.M. Buchanan* 3786 (AD, HO).

2. **Euryops chrysanthemoides* (DC.) B.Nord., *Opera Bot.* 20: 365 (1968)

Gamolepis chrysanthemoides DC., *Prodr.* 6: 443 (1838).

Type: South Africa, *Ecklon & Zeyher* 10.9; lecto: G, *fide* B.Nordenstam, *loc. cit.*

Shrubs to c. 1.5 m high, largely glabrous. Leaves crowded, slightly fleshy; narrow-elliptic to obovate, to 8 cm long, pinnatisect reducing to lobate distally, segments c. narrow-oblong, margins entire. Capitula 1 per branch but often with a few branches clustered; peduncle to c. 200 mm long; involucre broad-campanulate, 5–8 mm long; phyllaries 8–15, connate in proximal 1/5–1/4, sterome flat, resin ducts inconspicuous; margin of receptacular pits raised. Ray florets 8–15; ligule to c. 20 mm long, commonly 4-veined. Disc florets numerous; corollas c. 4.5 mm long, with base c. 0.5 mm diam; limb c. 2/3 of total length. Achenes obovoid, 3–5 mm long, 10-ribbed, glabrous, without stylophore. Pappus absent. *Paris Daisy*.

Notes: Native to South Africa. Occurs in central coastal New South Wales from Wollongong north to Northbridge, Sydney. A weed of roadsides. Incipiently naturalised at Leongatha in south-eastern Victoria. Flowers winter.

A common garden plant, occasionally escaping into adjoining bushland.

Representative specimens: NEW SOUTH WALES: Central Coast, Northbridge, L.A.S. Johnson 7517 (NSW). VICTORIA: Leongatha township, public land between Young St and Haw St, G.W. Carr 0205-77 (AD, CANB, HO, MEL, NSW).

8. *Cineraria* L., *Sp. Pl.* 2nd edn, 2: 1242 (1763)

Herbs or subshrubs. Leaves sessile, pinnately veined. Capitula radiate (in Australia) or rarely discoid, pedunculate, calyculate; phyllaries free. Florets: ligule yellow; disc florets rarely functionally male; corolla-limbs yellow. Anthers obtuse or shortly sagittate. Style-branches recurved, with apex truncate, crowned with papillae, with terminal appendage minute, conical. Achenes $\pm$ homomorphic, obovate, compressed. Pappus caducous.

A genus of c. 30 species from Africa and Madagascar.

**Cineraria lyratiformis* G.V.Cron., *S. African J. Bot.* 65: 287 (1999)

Cineraria lyrata DC., *Prodr.* 6: 308 (1838), *nom. illeg. non* Ledeb. (1818).

Type: Northern Cape Nieuweveld, between Beaufort and Rhinosterkop, South Africa, Drege 711; *holo: G n.v., fide* G.V.Cron, *loc. cit.*

Herbs to c. 0.6 m high, glabrous or cobwebby. Leaves to 8 cm long, with l:w ratio c. 2–3, lyrate-pinnatifid; base auriculate; margin denticulate to dentate. Capitula several to many per stem; mature peduncle to c. 20 mm long; calycular bracteoles 3–6, narrow-ovate, 1–2 mm long; involucre 3.5–5 mm long; phyllaries 12–14, with resin ducts 3–5; receptacle smooth. Ray florets usually 7 or 8; ligule 3.5–6 mm long, yellow, usually 4-veined; disc florets 32–40, with corollas 3–4 mm long, exceeding phyllaries by c. 1–2 mm; basal cone c. 0.3 mm diam., limb c. 3/5 of total length, with triangular lobes. Achenes: body c. obovoid, 2–2.5 mm long, black or dark-brown; wings broad, pale, glabrous or minutely ciliate. Pappus 3–4 mm long, minutely and sparsely scabrid-barbellate. *Cineraria*, *African Marigold*.

Notes: Native to South Africa. Occurs in the Rylstone district, in central-eastern New South Wales. Grows in a wide range of soils in wasteland, cultivated land and on roadsides. Flowers summer.

A noxious weed in the mid-western county of eastern New South Wales. In South Africa it is reported to taint dairy products and to have poisoned pigs. Similar to some radiate species of *Senecio* but distinguished most readily by its compressed achenes.

Representative specimens: NEW SOUTH WALES: Central Western Slopes, 3 km east of Rylstone, 17 Feb. 1995, *G.Hennessy s.n.* (NSW); Oz Mtn, between Rylstone and Bylong, Wollemi National Park, *W.Cherry 98/3a, J.Allen, E.A.Brown & C.Pavich* (NSW).

9. *Senecio* L., *Sp. Pl.* 2: 866 (1753)

Herbs, shrubs or climbers, rarely gynodioecious. Leaves sessile, rarely petiolate, pinnately veined. Capitula radiate (with ligules much reduced in *Glossanthus* group) discoid or disciform, calyculate or ecalyculate; phyllaries free, rarely connate. Florets: ligule mostly yellow, occasionally pink or purple, rarely cream or white; disc florets with corolla-limbs mostly yellow or yellow-green, rarely pink or red. Anthers ecaudate. Style-branches recurved, with apex truncate or obtuse, crowned by papillae, without terminal appendage. Achenes homomorphic, rarely slightly dimorphic, obloid or oblong-ellipsoid, sometimes lageniform. Pappus caducous or persistent.

A diverse assemblage of species of this enormous genus occur in Australia, and the 87 native representatives have been informally classified here into seven morphological groups. Nine of the ten introduced species in Australia are grouped here for convenience, whereas the tenth, *S. madagascariensis* is placed in one of the eight native groups, the Lautusoid group. Five of the native groups are endemic to Australia, and the other two are composed largely of endemic species. The Disciform group in Australia contains only native species, but a few species also occur naturally in New Zealand. The Lautusoid group contains only endemic species with the exception of *S. madagascariensis*.

A complete key to groups, species, and infraspecific taxa in *Senecio* is presented below following descriptions of groups. The majority of species have recently been described in a series of papers by Thompson (2004a, 2004b, 2004c, 2005a, 2005b) and the reader is referred to these for details. Concise descriptions and supplementary notes for species in the *Macranthus* and *Ramosissimus* groups and for nine introduced species are presented here, these species not having been described in the aforementioned papers.

A. Disciform Group

Erect or sprawling, usually perennial herbs, sometimes weakly shrubby, not rhizomatous, or rarely shortly so, not glaucous. Coarse spreading hairs often present, conspicuous or not; fine hairs often present, conspicuous or not. Leaves generally thin. Capitula disciform, rarely discoid, calyculate, with bracteoles parallel-sided or nearly so, 1–5 mm long, 0.1–0.7 mm wide at mid-point, with hyaline margin absent or obscure; involucre 1–5 mm diam. (measured mid-involucre, unpressed); phyllaries 7–25, free; stereome drying green, flat or ridged, with resin ducts pale, generally inconspicuous, glabrous, or occasionally cobwebby, rarely woolly. Florets 12–c. 100, with corolla-limb much shorter than the tube; outer florets (50–) 65–80% of total number, with diam. at base of lobes 0.1–0.2 mm; central florets with diam. at base of lobes 0.2–0.4 (–0.7) mm. Achenes homomorphic, $\pm$ obloid or narrowly lageniform, 1–6 mm long, with ribs mostly flat, with papillose hairs (l:w ratio 1–6) or glabrous; carpopodium 1/4–1/2 diam. of body. Pappus caducous; scabridulous to $\pm$ smooth.

A widespread group of 40 species, recently revised by Thompson (2004a). Endemic except for four species which are also native to New Zealand. Outer florets have extremely reduced corollas with 2–4 minute lobes. Central florets also have rather slender corollas that are 4 or more often 5-lobed. The peduncle and base of the capitulum are often transiently or persistently cobwebby in this group. The

cobwebbiness around the base of the capitulum is largely due to fine hairs arising from the margin of the bracteoles. Species that are described as having peduncle and calyculus not cobwebby at anthesis generally have a glabrous peduncle but minute hair-bases may be present on the margin of the bracteoles.

Disciform Species

1. *Senecio minimus* Poir., *Encycl. suppl.* 5: 130 (1817)
2. *Senecio diaschides* D.G.Drury, *New Zealand J. Bot.* 12: 522 (1974)
3. *Senecio biserratus* Belcher, *Ann. Missonri Bot. Gard.* 43: 43 (1956)
4. *Senecio picridioides* (Turez.) M.E.Lawr., *J. Adelaide Bot. Gard.* 7: 292 (1985)
5. *Senecio bipinnatisectus* Belcher, *Ann. Missonri Bot. Gard.* 43: 41 (1956)
6. *Senecio distalilobatus* I.Thomps., *Muelleria* 19: 129 (2004)
7. *Senecio esleri* C.J.Webb, *New Zealand J. Bot.* 27: 565 (1989)
8. *Senecio bathurstianus* (DC.) Sch.Bip., *Flora* 28: 498 (1845)
9. *Senecio hispidulus* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 92, t. 34 (1834)
10. *Senecio hispidissimus* I.Thomps., *Muelleria* 19: 138 (2004)
11. *Senecio multicaulis* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 105 (1834)
 - a. *Senecio multicaulis* A.Rich. subsp. *multicaulis*
 - b. *Senecio multicaulis* subsp. *stirlingensis* I.Thomps., *Muelleria* 19: 143 (2004)
12. *Senecio glomeratus* Desf. ex Poir., *Encycl. suppl.* 5: 130 (1817)
 - a. *Senecio glomeratus* Desf. ex Poir. subsp. *glomeratus*
 - b. *Senecio glomeratus* subsp. *longifructus* I.Thomps., *Muelleria* 19: 148 (2004)
13. *Senecio extensus* I.Thomps., *Muelleria* 19: 150 (2004)
14. *Senecio laceratus* (F.Muell.) Belcher, *Ann. Missonri Bot. Gard.* 43: 51 (1956)
15. *Senecio runcinifolius* J.H.Willis, *Proc. Roy. Soc. Queensland* 62: 106, t. 7 (1952).
16. *Senecio longicollaris* I.Thomps., *Muelleria* 19: 156 (2004)
17. *Senecio tasmanicus* I.Thomps., *Muelleria* 19: 158 (2004)
18. *Senecio campylocarpus* I.Thomps., *Muelleria* 20: 139 (2004)
19. *Senecio glabrescens* (DC.) Sch.Bip., *Flora* 28: 498 (1845)
20. *Senecio quadridentatus* Labill., *Nov. Holl. Pl.* 2: 48, t. 194 (1806)
21. *Senecio dolichocephalus* I.Thomps., *Muelleria* 19: 167 (2004)
22. *Senecio queenslandicus* I.Thomps., *Muelleria* 19: 169 (2004)
23. *Senecio phelleus* I.Thomps., *Muelleria* 19: 171 (2004)
24. *Senecio microbasis* I.Thomps., *Muelleria* 19: 175 (2004)
25. *Senecio scabrellus* I.Thomps., *Muelleria* 19: 177 (2004)
26. *Senecio tenuiflorus* (DC.) Sieber ex Sch.Bip., *Flora* 28: 498 (1845)
27. *Senecio gunnii* (Hook.f.) Belcher, *Ann. Missonri Bot. Gard.* 43: 64 (1956)
28. *Senecio niveoplauus* I.Thomps., *Muelleria* 19: 183 (2004)

29. *Senecio prenauthoides* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 96 (1834)
30. *Senecio psilophyllus* I.Thomps., *Muelleria* 19: 189 (2004)
31. *Senecio lageniformis* I.Thomps., *Muelleria* 19: 189 (2004)
32. *Senecio uigrapicus* I.Thomps., *Muelleria* 19: 191 (2004)
33. *Senecio longipilus* I.Thomps., *Muelleria* 19: 193 (2004)
34. *Senecio oldfieldii* I.Thomps., *Muelleria* 19: 195 (2004)
35. *Senecio psilocarpus* Belcher & Albr., *Muelleria* 8: 113 (1994)
36. *Senecio squarrosus* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 107 (1834)
37. *Senecio macrocarpus* F.Muell. ex Belcher, *Muelleria* 5: 119 (1983)
38. *Senecio interpositus* I.Thomps., *Muelleria* 19: 205 (2004)
39. *Senecio georgianus* DC., *Prodr.* 6: 371 (1838)
40. *Senecio helichrysoides* F.Muell., *Trans. Proc. Victoria Inst. Adv. Sci.* 39 (1855)

Notes and Amendments to Thompson (2004a): An earlier legitimate name for *S. brevintubulus* I.Thomps. has now been identified based on examination of material of *Senecio esleri* sent from New Zealand. *Senecio esleri* was described by Webb (1989) from New Zealand collections made in and around Auckland where it apparently is a common weed. In Australia it has been recorded from only five localities; however, as they predate the New Zealand collections and because some collections appear to be from natural areas, the species appears more likely to be native to Australia. A collection not cited by Thompson, *J.H.Maiden & J.L.Boorman*, Brunswick River (NSW), has now also been identified as *S. esleri*.

A new name *S. campylocarpus* was published in Thompson (2004d) to replace the earlier but illegitimate name *S. glandulosus* (DC.) Sch.Bip. that was used in Thompson (2004a). The key to species has been modified from that of Thompson (2004a) to better characterise the distinction between *S. campylocarpus* and *S. longicollaris*. This involves small modifications to involucre length and achenial length specifications, and the addition of length ranges for the neck portion of the achenes.

An old specimen from eastern New South Wales, *coll. unknown*, Parramatta (MEL22507) that was placed with *S. longicollaris* is now excluded from that species. It is close to this species and to *S. campylocarpus*, but it has glabrous capitula, and its leaf shape, leaf-dentition and achenial shape in combination sets it apart. New collections are required to better characterise this entity.

Information regarding the occurrence of *Senecio dolichocephalus* in northern New South Wales was not detailed in the protologue of Thompson's revision. It has been recorded from Cobar, Fowlers Gap, Narromine and Euston in this state.

Senecio extensus is now recognised to occasionally have papillose hairs on its achenes. Two specimens from Victoria, *I.R.Thompson* 757 MEL, CANB and *A.C.Beaglehole* 37001 MEL, have longitudinal bands of hairs on their achenes but otherwise conform to the original circumscription of *S. extensus*. The key given below has been amended to accommodate this change in circumscription.

The description of *S. squarrosus* states on line 5 that leaves become "broader upwards". This is a typographical error and it should have read "narrower upwards".

B. Odoratus Group

Erect shrubs, subshrubs or perennials, not rhizomatous, or extensively rhizomatous in *S. behrianus*, glaucous or not. Coarse spreading hairs uncommon, generally inconspicuous; fine hairs sometimes present, mostly inconspicuous, sometimes forming a short wool. Leaves thin or somewhat fleshy. Capitula discoid or radiate, calyculate, with bracteoles ovate-lanceolate, or $\pm$ parallel-sided, 1–5 mm long, 0.1–0.5 mm wide at midpoint, with hyaline margin absent or obscure; involucre 1.5–3 mm diam.; phyllaries 7–14, free; stereome often gently ridged, glabrous or tomentose, with resin ducts often conspicuous, orange or reddish. Florets 8–40; ray florets absent or 4–8; ligule yellow; disc florets with corolla-limb equal to or longer than tube, with diam. at base of lobes 0.5–1.0 mm. Achenes homomorphic, $\pm$ obloid, 1.5–4 mm long, with ribs $\pm$ flat, with papillose hairs of l:w ratio 2–6 or glabrous; carpopodium 1/3–1/2 diam. of body. Pappus caducous; bristles scabridulous to $\pm$ smooth.

A group of ten species endemic to Australia, recently revised by Thompson (2004b). The group is largely confined to south-eastern Australia, but also extend westwards as far as Eucla in far eastern Western Australia and north-westwards into central Australia. *Senecio linearifolius* is adventive in New Zealand. The species have slender capitula, and discoid members can resemble species of the Disciform and Ramosissimus groups in capitular morphology. Generally speaking however, in the Odoratus group the disc is showier, i.e. with corollas more exerted and with larger limbs. Closer inspection also reveals differences in the sex of the florets in most instances.

List of species

1. *Senecio auethifolius* A.Cunn. ex DC., *Prodr.* 6: 371 (1838)
 - a. *Senecio auethifolius* A.Cunn. ex DC. subsp. *auethifolius*
 - b. *Senecio auethifolius* subsp. *brevibraetecolatus* I.Thomps., *Muelleria* 20: 73 (2004)
2. *Senecio euclaeusis* I.Thomps., *Muelleria* 20: 77 (2004)
3. *Senecio gawlerensis* M.E.Lawr., *J. Adelaide Bot. Gard.* 7: 292 (1985)
4. *Senecio lanibracteus* I.Thomps., *Muelleria* 20: 78 (2004)
5. *Senecio cunninghamii* DC., *Prodr.* 6: 371 (1838).
 - a. *Senecio cunninghamii* DC. var. *cunninghamii*
 - b. *Senecio cunninghamii* var. *fluiderseusis* I.Thomps., *Muelleria* 20: 84 (2004)
6. *Senecio hypoleucus* F.Muell. ex Benth., *Fl. Austral.* 3: 672 (1867)
7. *Senecio odoratus* Hornem., *Hort. Bot. Hafn.* 2: 809 (1815)
8. *Senecio linearifolius* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 129 (1834)
 - a. *Senecio linearifolius* var. *linearifolius*
 - b. *Senecio linearifolius* var. *denticulatus* I.Thomps., *Muelleria* 20: 93 (2004)
 - c. *Senecio linearifolius* var. *latifolius* I.Thomps., *Muelleria* 20: 96 (2004)
 - d. *Senecio linearifolius* var. *intermedius* I.Thomps., *Muelleria* 20: 98 (2004)
 - e. *Senecio linearifolius* var. *arachnoidens* I.Thomps., *Muelleria* 20: 98 (2004)
 - f. *Senecio linearifolius* var. *macrodonatus* (DC.) I.Thomps., *Muelleria* 20: 102 (2004)

- g. *Senecio linearifolius* var. *dangarensis* Belcher ex I.Thomps., *Muelleria* 20: 104 (2004)
- h. *Senecio linearifolius* var. *gariwerdeusis* I.Thomps., *Muelleria* 20: 104 (2004)
- i. *Senecio linearifolius* var. *graniticola* I.Thomps., *Muelleria* 20: 108 (2004)
- 9. *Senecio belirianus* Sond. & F.Muell. ex Sond., *Linnaea* 25: 527 (1853)
- 10. *Senecio garlandii* F.Muell. ex Belcher, *Muelleria* 6: 173 (1986)

Notes and Amendments to Thompson (2004b): Achenes of *Senecio linearifolius* A.Rich. var. *arachnoideus* were described as 2.0–2.5 mm long. Further investigations have revealed shorter achenes in this variety and the range is amended here to (1.1–) 1.6–2.5 mm long. Although it was indicated that this variety occurred on the east coast of Tasmania, the distribution map did not mark its occurrence at Mayfield Beach. It has since also been recorded much further south at Tesselated Pavement. At both Tasmanian locations achenes have been papillose-hairy.

C. Ramosissimus Group

Erect gynodioecious perennial herbs, not rhizomatous, not glaucous. Coarse spreading hairs absent or inconspicuous; fine hairs sometimes present, sometimes conspicuous. Leaves generally thin. Capitula discoid with all florets female with concealed staminodes or on different plants all florets bisexual, or capitula radiate, calyculate, with bracteoles 1–2 mm long, 0.2 mm wide, $\pm$ parallel-sided, with hyaline margin absent or obscure; involucre 1.2–2.5 mm diam.; phyllaries 7–14, free; stereome nearly flat or convex, glabrous, with resin ducts inconspicuous, pale. Florets 9–25; all tubular and uniform in size and either bisexual or female (with staminodes present), or 1–3 ligulate, female; ligule white or pink; disc florets with corolla-limb equal to tube, diam. at base of lobes 0.5–1.0 mm (bisexual); c. 0.3–0.5 mm (female). Achenes homomorphic, $\pm$ obloid, 1.0–2.0 mm long, with ribs $\pm$ flat, with short papillose hairs (l:w ratio c. 2–3); carpodium 1/3–1/2 diam. of body. Pappus caducous; bristles nearly smooth.

A group of four species endemic to far south-western Western Australia. Unique among Australian species of *Senecio* in being gynodioecious. The florets of female plants have five staminodes which generally do not exceed the corolla and the corolla has a less dilated limb than in bisexual plants. *Senecio gilbertii* and *S. barkhausioides* are both poorly known and there have been no recent collections of these species. Further investigation into this group is desirable.

1. *Senecio leucoglossus* F.Muell., *Fragm.* 2: 15 (1860)

Type: Harvey and Murray R. region, W.A., *A.Oldfield*; possible iso: MEL.

Herbs to c. 1.0 m high, $\pm$ glabrous. Leaves to c. 10 cm long, with l:w ratio c. 2–3, coarse-dentate to pinnatisect, with 2–5 projections per side; base with well-developed auricles. Capitula several to many per stem; calycular bracteoles 2–4, 1 mm long; involucre c. 3.5 mm long, 1.2–1.5 mm diam.; phyllaries 7–9. Florets 9–13; ray florets 1–3, with ligules 4 mm long, white, sometimes tinged pink. Achenes 1.5 mm long, with papillose hairs in bands. Pappus c. 3 mm long.

Notes: Occurs in far south-western Western Australia south of Perth. Grows in red-brown gravelly clay and sandy clay in forest. Flowers late winter–spring.

Readily distinguished by its small capitula with a few, white or pink-tinged ligules. The lower leaves are distinctive in being entire and narrow proximally before

broadening abruptly. The broad portion of lamina is about as long as broad. A few old specimens from Perth area are more robust and leaf shape is slightly atypical; further collections of this form are desirable.

Representative specimens: WESTERN AUSTRALIA: Serpentine, 24 Sept. 1899, *coll. unknown* (AD, BRI, CANB, HO, MEL, NSW, PERTH); track off Sandalwood Rd towards Mornington Mills, SE of Harvey, *T.R.Lally TRL1502 & B.Fuhrer* (CANB, PERTH).

2. *Senecio gilbertii* Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 24(1): 208 (1851)

Type: Locality unknown, *Gilbert 289; n.v.*

Herbs to c. 1.0 m high. Stems transiently woolly. Leaves to c. 10 cm long, with l:w ratio c. 1.5–3, pinnatisect, with 2–5 oblong to obovate segments per side; base with well-developed auricles; margin with scattered denticulations; upper surface glabrous or sparsely hispid; lower surface somewhat densely appressed-cobwebby or woolly. Capitula numerous per stem; calycular bracteoles 3–6 1.5–2.0 mm long; involucre 4.0–5.0 mm long, c. 1.5 mm diam.; phyllaries 12–14. Florets 20–25, all tubular. Achenes narrow-obloid, c. 2 mm long, with papillose hairs in broad bands. Pappus 5 mm long.

Notes: Occurs in the Darling Ranges of south-western Western Australia. Habitat unknown. Flowers mostly winter–spring.

There have been no recent records of this species. The deeply pinnatisect leaves with very acute denticulations and a more or less dense indumentum on the lower surface are diagnostic.

Representative specimens: WESTERN AUSTRALIA: Wooroloo, Sept. 1907, *M.Koch s.n.* (PERTH); Darling Ra., *M.Koch 1692* (MEL).

3. *Senecio ramosissimus* DC., *Prodr.* 6: 371 (1838)

Type: Bald-Head hill, King George Sound, W.A., 1822, *A.Cunningham s.n.*; holo: G; microfiche seen MEL.

Senecio cygnorum Steetz, *Pl. Preiss* 1: 483 (1845). Type: Swan River, near Fremantle, W.A., 1843, *J.A.L.Preiss 70*; holo: MEL; iso: MEL.

Herbs to c. 1.5 m high, glabrous. Leaves to c. 17 cm long, with l:w ratio c. 3–6, undivided; base of upper-stem leaves with well-developed auricles, or truncate to sagittate; margin with frequent to crowded denticulations. Capitula numerous to 100s per stem; calycular bracteoles 2–4, c. 1 mm long; involucre 3.0–4.5 mm long, c. 2 mm diam., glabrous; phyllaries 9–13. Florets 15–20, all tubular. Achenes obloid, 1.0–1.5 mm long, with papillose hairs somewhat scattered. Pappus 3–4 mm long.

Notes: Occurs in far south-western Western Australia. Grows in sand and gravelly loam over limestone or granite, in coastal swamps, heathland, woodland and forest. Flowers spring–summer.

The inflorescences of *S. ramosissimus* are unusual for *Senecio* in Australia in being pyramidal, i.e. with lateral clusters of capitula not reaching to medial clusters.

Representative specimens: WESTERN AUSTRALIA: Small un-named lake/swamp 0.5 km north of Ledge Point, *A.E.Orchard 5931* (HO, MEL, PERTH).

4. *Senecio barkhausioides* Turcz., *Bull. Soc. Imp. Naturalistes Moscon* 24(2): 86 (1851)

Type: 'Nova Hollandia' [Swan River, W.A.], *J.Drmmmond V*, 378; iso: PERTH.

Herbs to c. 0.6 m high, with stems densely hispid basally. Leaves to c. 15 cm long, with l:w ratio c. 20–40, undivided or lobate, with 1–4 c. triangular lobes per side; base without auricles; margin entire or with a few teeth; upper surface hispid or sometimes upper-stem leaves glabrous; lower surface glabrous or with coarse hairs on midrib and major veins. Capitula several per stem; calycular bracteoles 6–8 2.0–3.0 mm long; involucre c. 7 mm long, c. 2.5 mm diam.; phyllaries 12–14. Florets numerous, all tubular. Achenes narrow-obloid, c. 2.5 mm long, with papillose hairs in bands. Pappus 6–7 mm long.

Notes: Occurs in far south-western Western Australia. Ecological preferences unknown. Flowering time unknown.

Senecio barkhausioides is a poorly known species that on the limited material available belongs in the *Ramosissimus* group. It has not been collected since the 1800s (One specimen, Parkers Range, 1890, *E.Merrall* is at MEL). Although placed in this group because of evidence that it is gynodioecious, it resembles species in the disciform group such as *S. oldfieldii* and *S. longipilus* in terms of leaf and stem indumentum, and *S. interpositus* and *S. georgianus* in terms of its phyllaries which have a fleshy stereome and strongly recurved apex.

Representative specimens: WESTERN AUSTRALIA: Parkers Ra., 1890, *E.Merrall* (MEL).

D. Magnificus Group

Erect, annual or perennial herbs or shrubs, not rhizomatous, often glaucous. Coarse spreading hairs sometimes present, generally not conspicuous; fine hairs $\pm$ absent. Leaves mostly somewhat fleshy. Capitula radiate, 1–several, or sometimes numerous, ecalyculate or calyculate, with bracteoles 1–5 mm long, 0.2–0.5 mm wide at mid-point, with hyaline margin absent or obscure; involucre 3–10 mm diam.; phyllaries 12–22, free or occasionally fused; stereome flat, glabrous except in *S. tuberculatus*, with resin ducts fine, pale. Florets mostly numerous, rarely 20–30; ray florets (4–) 6–12 (–16), rarely sterile, with ligule yellow; disc florets with corolla-limb shorter, equal to, or longer than tube, diam. at base of lobes c. 1 mm. Achenes homomorphic, obloid or lageniform, 2–10 mm long, with ribs absent or not, sometimes much raised; with papillose hairs (l:w ratio 4–20) or granular papillae; carpodium 1/3–1/2 diam. of body. Pappus persistent, or caducous in *S. velleioides*; bristles scabridulous or barbellate (mainly in proximal half) or rarely prominently barbellate.

A group of ten endemic species, widespread in southern and central Australia, particularly in arid and semi-arid environments. The peduncles in members of this group are often markedly dilated distally, a character not seen in other Australian species.

List of species

1. *Senecio platylepis* DC., *Prodr.* 6: 371 (1838)
2. *Senecio tuberculatus* Ali, *Kew Bull.* 19: 423 (1965)
3. *Senecio murrayanus* Wawra, in H.R. von F.Wawra & G.R. von M.Beck, *Itin. Princ. S. Cobnrgi* 2: 48 (1888)
4. *Senecio gregorii* F.Muell., *Ennm. Pl. Coll. Gregory* 7 (1859)

5. *Senecio conferruminatus* I.Thomps., *Muelleria* 20: 117 (2004)
6. *Senecio gypsicola* (R.Bates) I.Thomps., *Muelleria* 20: 117 (2004)
7. *Senecio megaglossus* F.Muell., *Linnaea* 25: 419 (1853)
8. *Senecio magnificus* F.Muell., *Linnaea* 25: 418 (1853)
9. *Senecio pilosicristus* I.Thomps., *Muelleria* 20: 121 (2004)
10. *Senecio velleioides* A.Cunn. ex DC., *Prodr.* 6: 374 (1838)

E. *Macranthus* group

Erect sometimes scapiform perennial herbs or semi-shrubs, rhizomatous or not, not glaucous. Coarse hairs sometimes present, mostly inconspicuous; fine hairs sometimes present, mostly inconspicuous. Leaves thin or slightly fleshy. Capitula radiate, calyculate, with bracteoles parallel-sided or nearly so, (2.5–) 4–9 mm long, 0.6–1.2 mm wide at mid-point, with hyaline margin absent; involucre 3–15 mm diam.; phyllaries 10–30, free, nearly flat or rarely ridged, glabrous, or with hairs in *S. vagus*, with resin ducts inconspicuous. Florets 20–numerous; ray florets (5–) 8–20; ligule yellow, or cream in *S. albogilvus*; disc florets with corolla-limb equal to or slightly longer than tube, with diam. at base of lobes, 0.7–1.0 mm. Achenes homomorphic, $\pm$ obloid, 2–8 mm long, with ribs raised or not, with papillose hairs (l:w ratio 6–12) in *S. vagus* or glabrous; carpodium nearly as broad as body in scapiform species, otherwise much narrower. Pappus persistent or not; bristles scabridulous.

Species in this group occur in south-eastern Australia in mesic environments with the exception of *S. daltonii* which occupies semiarid regions inland from the Great Dividing Range. Relatively large, herbaceous, strap-shaped calyculary bracteoles characterise this group, and most species have glabrous achenes. Several species have leaves with a somewhat abrupt transition from a petiole or petiole-like portion to the broad laminar portion. This is not seen in other native species of *Senecio* in Australia with the exception of *S. hypoleucus* and *S. linearifolius* (in a few varieties) in the *Odoratus* group. The term scapiform means that the plant develops a persistent rosette of basal leaves and all or most leaves on the flowering stem are much reduced.

1. *Senecio vagus* F.Muell., *Defin. Austral. Pl.* 13 (1855)

Type: Mt Dandenong Ranges, Jan. 1853, *F.Mueller*; lecto: MEL, *fide* S.I.Ali, *Kew Bull.* 19: 426 (1965); isolecto: MEL.: Mt Disappointment, *F.Mueller*; remaining syn: MEL.

Perennials to c. 1.5 m high, with rhizome not known, with hairs generally sparse. Leaves usually somewhat abruptly broadening from petiole-like to broad-laminate, to 15 cm long, with l:w ratio 1–4, pinnatisect proximally, with 1–3 segments per side, reducing to lobate beyond mid leaf (branch leaves may be undivided); base without auricles; margin entire or with occasional teeth or denticulations; venation $\pm$ distinct below; scattered hairs usually present, mainly marginal and on veins. Capitula several or sometimes numerous per stem; calyculary bracteoles 10–16, 5–10 mm long; involucre 7–13 mm long, c. 4–6 mm diam.; phyllaries 12–16, flat, with multicellular, pigmented hairs, or glabrous. Florets numerous; ray florets 8; ligule 10–20 mm long, 7- or 8-veined. Achenes obloid, 3–4 mm long, glabrous or with papillose hairs along summit of ridges; l:w ratio of hairs 6–12. Pappus caducous, 5–7.5 mm long. *Saw Groundsel*.

Notes: A species of wetter forests readily recognisable by the shape of leaves, the number of veins on the ligule, and the strongly ridged achenes. The calyculary bracteoles

somewhat unusually tend to curl and becoming divergent from the capitulum. There are two subspecies which appear to be allopatric.

a. *Senecio vagus* F.Muell. subsp. *vagus*

S. vagus F.Muell. var. *alpestris* F.Muell., *Trans. Proc. Phil. Soc. Victoria* 1: 46 (1855). Type: Mount Buller, 5000', *F.Muelleri*; ?holo: MEL.

Leaves with short hispid hairs along margin and veins. Capitula: calycular bracteoles with margin appearing denticulate due to coarse hair-bases; phyllaries and peduncles with scattered plump hairs. Achenes usually glabrous.

Notes: Occurs in eastern Victoria from the Dandenong Ranges east of Melbourne east to Mt Kaye; also occurs in Nullica State Forest in far south-eastern New South Wales, and on Flinders Is. in Bass Strait. Grows mostly in tall open forest. Flowers spring–autumn.

Readily distinguishable by the dark hairs scattered over the surface of phyllaries. The hairs are relatively plump and multicellular in 1–several series.

Representative specimens: NEW SOUTH WALES: Mt Comerang, 8 km e. SW of Bodalla, South Coast, *E.F.Constable* 4148 (NSW). VICTORIA: Small fenced gully at 449 Main Rd, Mt Macedon, *D.E.Albrecht* 472 (MEL). TASMANIA: Walkers Hill, 495 m WSW of the summit, Flinders Is., Fumeaux Group, *J.Whinray* 6 (HO).

b. *Senecio vagus* subsp. *eglandulosus* Ali, *Kew Bull.* 19: 427 (1965)

Type: New South Wales, Wilson R., Bellangry S.F., NW of Wauchope, 31 Oct. 1956, *E.F.Constable s.n.*; holo: NSW.

Leaves glabrous or nearly so. Capitula: calycular bracteoles with margin nearly smooth; phyllaries and peduncle glabrous. Achenes usually with hairs in lines along ribs.

Notes: Occurs in north-eastern and central-eastern New South Wales from the Gibraltar Ra. south to Picton. Grows in tall open forest or closed forest. Flowers mostly spring.

Representative specimens: NEW SOUTH WALES: Ballengarra State Forest, SW of Kempsey, *P.Gilmour* 7344 (AD, CANB, MEL, NSW); Wingen Maid Nature Reserve, *J.R.Hosking* 805 (CANB, MEL, NE, NSW).

2. *Senecio macranthus* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 126 (1834)

Type: New South Wales, Port Jackson, [probably collected inland from here], 1826–1829, coll. unknown; holo: P.

Perennials to c. 1 m high, not rhizomatous, largely glabrous. Leaves gradually broadening from base, to 12 cm long, with l:w ratio 12–25, undivided; base attenuate, with narrow auricles; margin entire or serrulate; venation inconspicuous. Capitula few to several per stem; calycular bracteoles 8–12, 4–9 mm long; involucre 8–12 mm long, c. 7–8 mm diam.; phyllaries 14–22, ridged proximally. Florets numerous; ray florets 8–13; ligule 15–25 mm long, 4–7-veined. Achenes obloid–narrow-obloid, 3–5 mm long. Pappus caducous, 8–10 mm long.

Notes: Occurs in eastern New South Wales from Wollomombi Falls west to the Warrumbungle Ranges and SSW to Tallong. Grows in moister gullies, often in rocky sites, including granite, sandstone and basalt, in forest. Flowers late winter–spring.

Representative specimens: NEW SOUTH WALES: Killiecrankie Pass, 9.1 km west of Goodmans Ford on the Wombeyan Caves Rd, *R.Coveny 12169, W.Bishop & R.Makinson* (AD, NSW); Track from Wollomombi Falls to Chandler R., Oxley Wild Rivers National Park, *P.Gilnour 7844* (CANB).

3. *Senecio amygdalifolius* F.Muell., *Fragm.* 1: 232 (1859)

Type: New South Wales, Hastings R., *Dr Beckler*; syn: MEL.

Perennials to c. 3 m high, with rhizome villous, otherwise $\pm$ glabrous. Leaves $\pm$ abruptly broadening from petiole-like to broad-laminate, to 20 cm long, with l:w ratio 3–7; base without auricles; margin with crowded serrulations; reticulate venation distinct on lower surface. Capitula several to many per stem; calycular bracteoles 5–10, 2.5–8 mm long; involucre 7–10 mm long; 3–5 mm diam.; phyllaries 10–12. Florets 20–35; ray florets 5–8; ligule 10–15 mm long, 4- or 5-veined. Achenes narrow-obloid, 4–6 mm long. Pappus caducous, 6–8 mm long.

Notes: Occurs within 200 km of the coast in far eastern Australia from Mt Molangul in south-eastern Queensland south to Morrisett in central-eastern New South Wales with a disjunct occurrence near Coonabarabran much further inland in north-eastern New South Wales. Grows in open and closed forest. Flowers mostly winter–spring.

Readily distinguished by its petiolate, serrulate leaves.

Representative specimens: QUEENSLAND: Mount Ballow foothills, McPherson Ra., *P.I.Forster PIF7459 & G.Leiper* (BRI, MEL, PERTH). NEW SOUTH WALES: Undercliffie Falls, 10 km east of Liston, *A.R.Bean 6634* (BRI, MEL, NSW).

4. *Senecio daltonii* F.Muell., *Fragm.* 6: 27 (1861), as *Daltoni*

Type: Warrego R., Currewillighi, Queensland, *J.D.Dalton*; holotype: MEL.

Perennials to c. 0.5 m high, with extensive villous rhizomes, with stem hairs mostly inconspicuous. Leaves gradually broadening from base, to 12 cm long, with l:w ratio 8–15, undivided; base attenuate, without auricles; margin entire, or with occasional denticulations; venation inconspicuous; scattered coarse hairs sometimes present. Capitula 1 or few per stem; calycular bracteoles 6–8, 4–7 mm long; involucre 8–14 mm long, c. 7–10 mm diam.; phyllaries 14–25, with scattered coarse hairs. Florets numerous; ray florets 10–15; ligule 6–12 mm long, 4- or 5-veined. Achenes $\pm$ narrow-obloid, c. 3–5 mm long. Pappus persistent, 12–20 mm long.

Notes: Occurs in central-eastern Australia from Toowoomba in far south-eastern Queensland SW to Forbes in central New South Wales and WSW to Brewarrina in north-central New South Wales. Grows in heavier soils in swampy country and in cultivated paddocks. Flowers at most times of year, dependent on rains.

Much maligned as a weed of cultivation during the 1930s–60s as it apparently could survive ploughing. Information about its natural habitat is limited and there have been no recent reports of it being troublesome in cultivation.

Representative specimens: QUEENSLAND: Darling Downs District, 13 May 1948, *C.S.Clydesdale* (BRI). NEW SOUTH WALES: 5 km north of Brewarrina, *J.Thompson 1870a* (BRI, NSW); Rowena district, 6 Oct. 1966, *J.Crosby* (NSW).

5. *Senecio leptocarpus* DC., *Prodr.* 6: 372 (1838)

S. pectinatus DC. var. *pleiocephalus* Benth., *Fl. Austral.* 3: 665 (1867).

Type: Mt Wellington, Tasmania, *R.C.Gunn* 268; holo: G; iso: NSW both *n.v.*, *fide* R.O.Beleher, *Muelleria* 9: 122 (1996).

Scapiform perennials to 0.5 m high, rhizomatous, nearly glabrous except for upper peduncle. Basal leaves gradually broadening from base, to 10 cm long, with l:w ratio 3–9, undivided or lobate, with 4–7 lobes per side; base attenuate or euneate, without auricles; secondary venation sub-parallel, generally distinct on both sides. Cauline leaves c. 10, undivided, becoming much smaller than basal leaves. Capitula (1–) 3–8 per stem; peduncle with coarse hairs distally; calyular bracteoles 4–8, 4–7 mm long; involucre 5–9 mm long, 3–5 mm diam., phyllaries c. 13, glabrous. Florets numerous; ray florets 10–15; ligule 8–12 mm long, 4–6-veined. Achenes narrow-obloid, 3–4 mm long, unribbed. Pappus persistent, 4–5 mm long.

Notes: Occurs in central and western Tasmania from St Valentines Peak in the far north-west south to Pindars Peak in the far south. Grows in alpine shrubland, heathland and herbfields. Flowers summer–autumn.

Differs from *S. pectinatus* by its strongly discolorous leaves with distinct sub-parallel or very acute secondary venation. The leaves are similar to those of *S. albogilvus* but are larger and with more lobes. It also differs from *S. albogilvus* in that the inflorescences are usually not solitary, and ligules are yellow. Although there are a few old records from the mainland, there is some doubt about their provenance.

Representative specimens: TASMANIA: Lake Hwy, 5.7 km north from Breona, Great Western Tiers, *F.E.Davies* 983 & *P.Ollerenshaw* (CANB, MEL); Dunning Rivulet, *A.Moscal* 12524 (HO).

6. *Senecio albogilvus* I.Thomps., *Muelleria* 20: 130 (2004)

S. pectinatus var. *ochroleucus* F.Muell., *Papers & Proc. Roy. Soc. Tasmania* 1870, 16 (1871), as *ochroleuca*.

Type: Mt Wellington, Tasmania, Jan. 1869, *F.Mueller*; lecto: MEL, *fide* R.O.Beleher, *Muelleria* 9: 119 (1996); syn: MEL.

Scapiform perennials to c. 0.3 m high, rhizomatous, nearly glabrous. Basal leaves gradually broadening from base, to 4 cm long, with l:w ratio 8–15, undivided; base attenuate, without auricles; margin entire or more often with 1 or 2 distal serrations per side; venation indistinct. Cauline leaves 10–15, becoming much smaller than basal leaves, mostly bract-like, undivided; base without auricles. Capitula 1 per stem; distal peduncle sparsely hairy, with hairs fine; calyular bracteoles 6–10, 4–9 mm long; involucre 5–11 mm long, 3–7 mm diam.; phyllaries 12–22, glabrous. Florets numerous; ray florets 10–15; ligule 8–12 mm long, cream-white, 4- or 5-veined. Achenes narrow-obloid, 2–3 mm long, unribbed, glabrous. Pappus uncertainly persistent, 4.5–6 mm long.

Notes: Occurs in north-western and southern Tasmania from Cradle Mountain south to Pindars Peak. Grows in rocky sites in herbfield, heathland and shrubland in montane to alpine regions. Flowers summer–autumn.

The undivided, discolorous leaves of this species are reminiscent of those of *S. leptocarpus*, although considerably smaller. A further distinctive feature of this species is the white-cream colour of the ligules. An old specimen collected by a Dr Milligan

from Tasmania (MEL667723) has the leaves of *S. albogilvus* but has an inflorescence of six capitula. It is unclear from the specimen what the colour of the ligules are. This may be an aberrant plant or possibly a hybrid between *S. albogilvus* and *S. leptocarpus*.

When elevated to species rank (Thompson 2004c) the authority was incorrectly cited as (F.Muell.) I.Thomps.

Representative specimens: TASMANIA: Eastern edge of Cradle Mountain c. 100 m below summit, Cradle Mountain National Park, *P.S.Short 1786* (HO, MEL); Hartz Mountain track, 500 m from base of track, Hartz Mountains National Park, *F.E.Davies 878* & *P.Ollerenshaw* (AD, CANB, HO, MEL).

7. *Senecio pectinatus* DC., *Prodr.* 6: 372 (1838)

Type: Precise locality unknown, Tasmania, 1832, *R.C.Gunn 107*; holo: G *n.v.*, *fide* R.O.Belcher, *Muelleria* 9: 115–131.

Scapiform perennials to 0.5 m high, rhizomatous, nearly glabrous except for scape and peduncle. Basal leaves gradually to somewhat abruptly broadening from petiole-like portion to lamina, to 15 cm long, with l:w ratio 2–6, dentate to pinnatisect, with 3–6 major projections per side; base petiole-like, without auricles. Cauline leaves 5–12, becoming much smaller than basal leaves, mostly undivided; base without auricles or slightly dilated. Capitula 1 per stem, or rarely 2; distal peduncle moderately hairy, with hairs to c. 1 mm long; calycular bracteoles 6–12, (4–) 5–10 mm long; involucre 6–12 mm long, 5–12 mm diam.; phyllaries 12–30, glabrous or nearly so. Florets numerous; ray florets 13–20; ligule 10–20 mm long, 4- or 5-veined. Achenes narrow-obloid 4–8 mm long. Pappus uncertainly persistent, 4–7.5 mm long.

Notes: There are two varieties of this species differing mainly in their dimensions, although there are subtle differences in leaf morphology also. Although the demarcation of the varieties is not always clear, particularly due to collections from Ben Lomond National Park, Tasmania, I consider that the varietal status should be maintained. Geographically varieties are clearly separated. The high chromosome number of $2n = 80$ for var. *major* (Lawrence 1980) is suggestive of polyploidy. A chromosome count for the typical variety has not been made.

7a. *Senecio pectinatus* DC. var. *pectinatus*

Plants to c. 0.2 m high, with scape 0.5–1.8 mm diam. Rosette leaves 1–5 (–8) cm long, deeply lobate to pinnatisect, with medial zone of uninterrupted lamina not or only slightly broadening distally, 1–2 (–4) mm wide at widest. Capitula: calycular bracteoles (4–) 5–6.5 mm long, 0.6–1.1 mm wide; involucre 6–8 (–9) mm long, 8–15 (–20) mm wide when pressed, with phyllaries c. 13–20. Corolla of disc florets mostly < 6 mm long. Achenes 4–5 mm long. Pappus 4–5 mm long.

Notes: Occurs in Tasmania from Mt Arthur in the far north to Mt La Perouse in the far south. Robust, larger-headed specimens from Ben Lomond Natl Park and Mt Field Natl Park are considered to be var. *pectinatus* based on leaf morphology although in other respects dimensions overlap with those of var. *major*. Apart from these occasional specimens at these localities, specimens in Tasmania are readily distinguished from var. *major* using all or most of the characters presented in the descriptions. A specimen from Mount Buffalo, Victoria, referred to var. *pectinatus* by Thompson 2004e is now

considered to be var. *major*. Grows in alpine or sub-alpine herbfields, heathland and shrubland, commonly near streams or seepage areas. Flowers summer–autumn.

Representative specimens: TASMANIA: Between Ladies Tarn and Hartz Peak, Hartz Mtns National Park, *P.S.Short* 1892 (MEL); Hamilton Crags, 1.5 km east of Legges Tor, Ben Lomond National Park, *F.E.Davies* 1167 (AD, CANB, HO, MEL).

7b. *Senecio pectinatus* var. *major* F.Muell. ex Belcher, *Muelleria* 9: 120 (1996)

Type: Cobberas Mts, Victoria, [1854], *F.Mueller*; holotype: MEL; syn: MEL.

Plants to 0.3 (–0.5) m high, with scape 1–3 mm diam. Rosette leaves (3–) 4–15 cm long, dentate to pinnatisect, with medial zone of uninterrupted lamina clearly broadening distally, usually 4–15 mm wide at widest in at least some leaves. Capitula: calycular bracteoles 6–10 mm long, 1.0–2.0 mm wide; involucre 8–12 mm long, 15–30 mm wide when pressed, with phyllaries c. 20–30. Corolla of disc florets > 6 mm long. Achenes 4–8 mm long. Pappus 5–7 mm long. *Alpine Groundsel*.

Notes: Occurs in far south-eastern Australia. On the mainland it extends from Mt Kelly in southern parts of the Australian Capital Territory SW through south-eastern New South Wales to Mt Baw Baw in southern Victoria. Specimens from Ben Lomond, Tasmania, included by Thompson 2004e in var. *major* are now considered better placed in var. *pectinatus*. Grows in alpine or sub-alpine herbfields, heathland and shrubland, commonly near streams or seepage areas. Flowers summer–autumn.

Representative specimens: NEW SOUTH WALES: c. 1 km along Summit Rd from parking area, Mt Stillwell, Charlottes Pass, Kosciuszko National Park, *P.Hind* 5520 & *G.D'Aubert* (MEL, NSW). VICTORIA: beside road from "Ruined Castle", at head of ?McKay Ck, Bogong High Plains near Mt McKay, *M.G.Corrick* 11500 (CANB, MEL); Wall of Death, Hotham Heights, *D.E.Albrecht* 4949 (MEL).

8. *Senecio papillosus* F.Muell., *Trans. Phil. Inst. Victoria* 2: 69 (1857)

Type: Mt La Perouse, Tasmania, 1 Mar. 1857, *C.Stuart* 1870; lecto: MEL, *vide* R.O.Belcher, *Muelleria* 9: 124 (1996); Mt La Perouse, Tasmania, *Stuart s.n.*; syn: MEL.

Scapiform perennials to 0.3 m high, rhizomatous, somewhat hairy on most parts. Basal leaves to 4 (–7) cm long, with l:w ratio 2–7, undivided; base petiole-like; margin entire or with a scattered teeth; upper surface hispid with hairs rather robust; lower surface with long hairs along midrib; secondary venation ± distinct on lower surface. Cauline leaves much smaller than basal, 1–5, undivided; base without auricles. Capitula 1 per stem; distal peduncle and margin of bracteoles with coarse hairs; calycular bracteoles 6–8, 5–8 mm long; involucre 7–10 mm long, 3–5 mm diam.; phyllaries 12–24, sparsely hairy; Florets numerous; ray florets 12–20; ligule 10–20 mm long, 2- or 5-veined. Achenes narrow-obloid, c. 3–4 mm long, unribbed. Pappus uncertainly persistent, c. 6 mm long.

Notes: Occurs in far southern Tasmania from Federation Peak to Mt La Perouse. Grows in sub-alpine areas. Flowers summer–autumn.

Recognised by its scapiform habit and small spatulate leaves with rather coarse septate hairs on the upper surface. Very localised in mountains in south-western Tasmania.

Representative specimens: TASMANIA: Precipitous Bluff, east face, *A.M.Buchanan* 11347 (HO).

9. *Seuocio primulifolius* F. Muell., *Trans. Phil. Inst. Victoria* 2: 69 (1857)

Type: Mt La Perouse, Tasmania, 1 Mar. 1857, *C. Stuart* 1871; lecto: K, *fide* R.O. Belcher, *Muelleria* 9: 125 (1996); isolecto: MEL (2 sheets).

Scapiform perennials to 0.3 m high, rhizomatous, somewhat hairy on leaves and scape. Basal leaves abruptly broadening from petiole-like portion to cordate-based lamina, to 22 cm long, with l:w ratio 2–6, undivided; base without auricles; margin crenate or dentate; secondary venation distinct; upper surface somewhat appressed-cobwebby or woolly; lower surface somewhat woolly. Cauline leaves 1–4, becoming much smaller than basal leaves; base becoming auriculate upwards. Capitula 1–4 per stem; peduncle hairy; calycular bracteoles 6–8, 5–8 mm long; involucre 7–10 mm long, 3–5 mm diam.; phyllaries 14–20, nearly glabrous. Florets numerous; ray florets c. 12; ligule 10–20 mm long, 4- or 5-veined. Achenes narrow-obloid, 3–4 mm long, unribbed, glabrous. Pappus persistent, 6–8 mm long.

Notes: Occurs in far southern Tasmania in the area of Mt La Perouse. Grows in sub-alpine areas, where recorded from under shrubs and from rocky cliffs. Flowers summer–autumn.

Recognised by its scapiform habit and distinctive leaf morphology. Like *S. papillosum*, it has a very localised distribution in mountains in south-western Tasmania.

Representative specimens: TASMANIA: Moonlight Ridge, *A.M. Buchanan* 2961 (HO); Mt La Perouse, *L. Rodway* 427 (HO).

F. *Glossanthus* group

Erect annuals, not rhizomatous, not glaucous. Coarse hairs sometimes present, conspicuous or not; fine hairs absent. Leaves commonly slightly fleshy. Capitula radiate, with ligule short, or appearing disciform with ligule of female florets vestigial, calyculate, with bracteoles narrow-ovate to lanceolate, 0.8–3.0 mm long, 0.2–0.8 mm wide at mid-point, with hyaline margin absent or obscure; involucre 1–3 mm diam.; phyllaries 7–13, free; stereome flat, with resin ducts inconspicuous, pale. Florets 15–numerous; ray florets (4–) 5–13, with ligule much reduced, yellow; disc floret: corolla-limb $\pm$ as long as tube, with diam. at base of lobes, 0.3–0.5 mm. Achenes homomorphic or dimorphic (ray achenes larger, hairs more robust and carpopodium broader), $\pm$ obloid or slightly lageniform, 2.0–5.5 mm long, with ribs $\pm$ flat, with papillose hairs (l:w ratio 3–8); carpopodium c. 1/3–1 times diam. of body. Pappus caducous, occasionally hardly developed on outer achenes; bristles scabridulous.

A group of four species occurring in the southern half of Australia, distinguished from other radiate species by the short ligules of the female florets. The species in this group were recently revised by Thompson (2005a). The ligule in some specimens is vestigial but these can be distinguished from species of the Disciform group by the low proportion of female florets and the relatively short corolla of these florets, and in three of the species, the dimorphism of the achenes. The group is probably most closely allied to the Lautusoid group to which it is most obviously connected by *S. condylus*, a species placed in the Lautusoid group because of its long-ligulate female florets, but with features including leaf shape and achenial dimorphism that associate it with members of the *Glossanthus* group.

List of species

1. *Senecio glossanthus* (Sond.) Belcher, *Ann. Missouri Bot. Gard.* 43: 80 (1956)
2. *Senecio productus* I.Thomps., *Muelleria* 21: 10 (2005)
 - a. *S. productus* I.Thomps. subsp. *productus*
 - b. *S. productus* subsp. *magnus* I.Thomps., *Muelleria* 21: 10 (2005)
3. *Senecio halophilus* I.Thomps., *Muelleria* 21: 13 (2005)
4. *Senecio serratifornis* I.Thomps., *Muelleria* 21: 14 (2005)
 - a. *S. serratifornis* I.Thomps. subsp. *serratifornis*
 - b. *S. serratifornis* subsp. *steuophyllus* I.Thomps., *Muelleria* 21: 18 (2005)

Notes: *Senecio brachyglossus* var. *major* Benth., a homotypic synonym of *S. halophilus*, was lectotypified in Thompson (2005a). Since then, a duplicate has been found at MEL and this specimen is designated as an isoelectotype. There are two remaining syntypes that were cited by Bentham. The syntype from Wilsons Promontory has now been seen at MEL and is determined to be a hybrid between *S. biserratus* and *S. pinnatifolius* var. *lanceolatus*. A photograph of the syntype from Western Australia has been seen (specimen at K); this syntype is likely to be *S. serratifornis* I.Thomps.

The range of *S. productus* subsp. *productus* has increased with the recent identification of seven further specimens from central and southern inland New South Wales (all specimens held at NSW). The association with *S. glossanthus* alluded to in Thompson (2005a) was confirmed by several more mixed collections.

G. Lautusoid group

Erect, sprawling or nearly prostrate annuals, perennials, or semi-shrubs, not rhizomatous or scapiform except for *S. pinnatifolius* var. *pleiocephalus*, not glaucous. Coarse hairs generally caducous if present, except sometimes on peduncles, and lower surface of leaves (only *S. coudylus*); fine hairs absent. Leaves commonly slightly to strongly fleshy. Capitula radiate, calyculate, with bracteoles broad-ovate to narrow-lanceolate, 1–5 mm long, 0.3–2.0 mm wide at mid-point, with hyaline margin absent, obscure or well-developed; involucre 1.2–12 mm diam.; phyllaries (8–) 13–22, free; stereome flat or ridged proximally, with resin ducts broad and prominent or not, orange or pale. Florets numerous; ray florets 8–13 (–20), with ligule yellow; disc floret: corolla-limb $\pm$ as long as tube, 0.4–0.6 mm diam. at base of lobes. Achenes homomorphic or less often dimorphic (achenes of female florets larger, with hairs more robust and carpopodium broader), $\pm$ obloid, 1.5–7 mm long, with ribs flat to mildly raised, with papillose hairs (l:w ratio c. 3–8) or glabrous; carpopodium mostly c. 1/2 diam. of body. Pappus caducous, or persistent in *S. spathulatus*; bristles scabridulous.

A group of eleven species occurring throughout most of Australia south of latitude 20°S. This group was revised by Thompson (2005b). It has been termed the Lautusoid group because of the similarity of its members to *Senecio lautus*, now considered a New Zealand endemic. Belcher (1994) coined the term pseudolautusoid, but to me the prefix “pseudo” is misleading as I consider Australian taxa to be closely related to New Zealand taxa. Prior to Walsh (1999) and Thompson (2005b), the name *S. lautus* had been used for all native Australian species of this group. The introduced species *S. madagascariensis*, native to southern Africa and Madagascar, is included in this group.

The morphology of the phyllaries in some cases helps to distinguish species in this group and it is important therefore to be able to identify that there are three types of phyllary in any one capitulum: inner, outer and intermediate. The narrower outer

phyllaries have margins that overlap the margins of inner phyllaries to the outside. One or two intermediate phyllaries are likely to be present in any one capitulum; they are a chimera of outer and inner phyllaries, and so one margin will overlap to the inside while the other overlaps to the outside. Species in this group are listed below.

Corrigenda to Thompson 2005b: The illegitimate name *Senecio carmulentus* DC., *Prodr.* 6: 372 (1838) should have been placed in synonymy under *Senecio pinnatifolius* A.Rich.

In *S. lacustrinus*, phyllaries have recently been measured in some specimens in northern New South Wales, e.g. around Bourke, to be less than 5.0 mm long (5.0 mm was given as the minimum length given in the protologue). In other respects these plants are typical of the species.

The image of *Senecio bragalowensis* in Thompson is of the isotype, not the holotype as indicated in the caption.

List of Species

1. *Senecio condylus* I.Thomps., *Mnelleria* 21: 18 (2005)
2. *Senecio spathulatus* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 125 (1834)
 - a. *Senecio spathulatus* A.Rich. var. *spathulatus*
 - b. *Senecio spathulatus* var. *latifructus* I.Thomps., *Mnelleria* 21: 35 (2005)
 - c. *Senecio spathulatus* var. *attenuatus* I.Thomps., *Mnelleria* 21: 35 (2005)
3. *Senecio warrenensis* I.Thomps., *Muelleria* 21: 38 (2005)
4. *Senecio pinnatifolius* A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 117 (1834)
 - a. *Senecio pinnatifolius* A.Rich. var. *pinnatifolius*
 - b. *Senecio pinnatifolius* var. *latilobus* (Steetz) I.Thomps., *Mnelleria* 21: 45 (2005)
 - c. *Senecio pinnatifolius* var. *serratus* I.Thomps., *Muelleria* 21: 47 (2005)
 - d. *Senecio pinnatifolius* var. *laucolatus* (Benth.) I.Thomps., *Muelleria* 21: 49 (2005)
 - e. *Senecio pinnatifolius* var. *capillifolius* (Hook.f.) I.Thomps., *Muelleria* 21: 51 (2005)
 - f. *Senecio pinnatifolius* var. *alpinus* (Ali) I.Thomps., *Muelleria* 21: 52 (2005)
 - g. *Senecio pinnatifolius* var. *maritimus* (Ali) I.Thomps., *Mnelleria* 21: 54 (2005)
 - h. *Senecio pinnatifolius* var. *leucocarpus* I.Thomps., *Mnelleria* 21: 58 (2005)
5. *Senecio spanomerus* I.Thomps., *Muelleria* 21: 58 (2005)
6. *Senecio bragalowensis* I.Thomps., *Mnelleria* 21: 63 (2005)
7. *Senecio depressicola* I.Thomps., *Mnelleria* 21: 64 (2005)
8. *Senecio eremieola* I.Thomps., *Mnelleria* 21: 66 (2005)
9. *Senecio lacustrinus* I.Thomps., *Mnelleria* 21: 68 (2005)
10. *Senecio hamersleyensis* I.Thomps., *Muelleria* 21: 72 (2005)
11. **Senecio madagascariensis* Poir., *Encycl.*, suppl. 5: 130 (1817)

H. The Exotic Species

The nine exotic species grouped here, predominantly from South Africa, are somewhat diverse but are placed together here for convenience. They are radiate except for the discoid *S. vulgaris* and the group contains three climbing species. All naturalised species in Australia are placed here except for *S. madagascariensis* which has been placed in the Lautusoid Group.

1. **Senecio pterophorus* DC., *Prodr.* 6: 389 (1838)

S. pterophorus var. *vernus* Harv., *Fl. Capensis* 3: 386 (1865), *nom. inval.*

Type: Southern Africa, *Drege*; *holo*: G; microfiche seen MEL.

S. pterophorus var. *apterus* Harv., *Fl. Capensis* 3: 386 (1865), *nom. illeg.* Type: Southern Africa, *Drege*; *n.v.*

Erect perennials to c. 2 m high, with fine hairs sparse, denser on leaves. Leaves narrow-oblongeolate or narrow to very narrow-elliptic, to 14 cm long, with l:w ratio c. 4–8, shallowly to deeply serrate, occasionally $\pm$ entire or appearing so, with 2–7 projections per side; base attenuate, often with decurrent laminar tissue; upper surface sometimes sparsely tuberculate; lower surface appressed-woolly. Capitula several to many per stem; calycular bracteoles 14–20, 2–3 mm long, 0.3–0.5 mm wide; involucre 3.5–5 mm long, 3.5–4 mm diam.; phyllaries 18–22, glabrous. Florets numerous; ray florets 8–13, with ligule 4–7 mm long, 4-veined, yellow. Achenes obloid, 1.5–1.8 mm long, pale-brown, tapering more marked basally, with papillose hairs forming bands or evenly dispersed. Pappus caducous, 4–5 mm long. *African daisy*, *Rough Senecio*.

Notes: Native to South Africa. Occurs in south-eastern Australia from the Eyre Peninsula ESE to Garfield in south-central Victoria, and disjunctly further north-east in central-eastern New South Wales from Newcastle SW to the Blue Mountains east of Sydney. Grows mostly in disturbed sites in grasslands, woodland, and forest. Flowers mostly summer.

Readily distinguished by the usually acutely lobed leaves, sublustrous above and appressed woolly below, and often decurrent down the stems. Hybridises with disciform species such as *S. hispidulus* and *S. picridioides* and with the discoid species *S. hypoleucus* in the Mt Lofty Ranges of S.A.

Representative specimens: SOUTH AUSTRALIA: Cleland National Park, 10 km east of Adelaide, *S.L.Everist* 9995 (AD, BRI). NEW SOUTH WALES: Mt Druitt, *R.G.Coveny* 13911 (AD, BRI, CANB, MEL, NSW). VICTORIA: on Hamilton–Horsham Hwy adjacent to Cattle Station Ck, 7 Jan. 1986, *J.M.Pollock* (AD, CANB, MEL).

2. **Senecio jacobaea* L., *Sp. Pl.* 2: 870 (1753)

Type: Europe; *n.v.*

Erect biennials or perennials to c. 1.8 m high, with sparse to moderate cobwebby hairs. Leaves elliptic to narrow-elliptic, to 25 cm long, with l:w ratio c. 1.5–3, complexly 2–3-pinnatisect with c. 5–10 major segments per side; base attenuate or slightly auriculate, with auricles pinnatisect, slightly clasping. Capitula numerous to 100s per stem; calycular bracteoles 3–6, 2–3.5 mm long, 0.2–0.3 mm wide; involucre 3.5–5 mm long, c. 4 mm diam.; phyllaries 11–13, glabrous. Florets numerous; ray florets 10–15; ligule 6–10 mm long, 4-veined, yellow. Achenes obloid, 1.6–2.2 mm

long, pale-brown, tapering more marked basally; achenes of disc florets with papillose hairs in rows; achenes of ray florets glabrous. Pappus caducous, 4–5 mm long. *Ragwort*.

Notes: Native to Europe. Occurs in far south-western Western Australia west of Albany, far south-eastern Australia from the Mt Lofty Ra. in south-eastern South Australia east to Sale in eastern Vic, and in north-western and eastern Tasmania. A common weed in other temperate parts of the world. Grows in forest and in agricultural and disturbed land such as roadsides. Flowers summer–autumn.

A species with large intricately dissected leaves and inflorescences of numerous crowded capitula with relatively narrow ligules. In its first season it forms a basal rosette.

Representative specimens: WESTERN AUSTRALIA: Walpole, *R.D.Royce* 2566 (PERTH). SOUTH AUSTRALIA: Sturt Creek, Upper Surt District, 15 Nov. 1954, *V.Lohmeyer s.n.* (AD). NEW SOUTH WALES: Goulburn, 9 May 1938, *A.T.R.Brown s.n.* (NSW). VICTORIA: Beech Forest, *R.V.Smith* 75/5 (AD, BRI, CANB, HO, MEL, NSW, PERTH). TASMANIA: Pine L., northern Central Plateau, *A.E.Orchard* 5820 (AD, HO, MEL).

3. **Senecio elegans* L., *Sp. Pl.* 2: 869 (1753)

Type: 'Aethiopia', northern Africa, cult., seed from South Africa, Herb. Clifford 406, *Senecio* 4; lecto: ?LINN *fide* R.O.Beleher, *Fl. Australia* 49: 617 (1994).

S. elegans var. *diffusus* Ewart, *Fl. Victoria* 1173 (1931). Type: not designated.

S. elegans var. *erectus* Ewart, *Fl. Victoria* 1173 (1931). Type: not designated.

Erect or sprawling annual, to 1.0 m high, nearly glabrous. Leaves to 20 cm long, with l:w ratio c. 2–4, sub-pinnatisect with 2–5 major segments per side; segments typically broadest distally and irregularly lobed; base slightly to moderately auriculate, slightly clasping. Capitula few to numerous per stem; calycular bracteoles 12–16, 3–5 mm long, c. 1.5–2 mm wide; involucre 7–8 mm long, c. 5–7 mm diam.; phyllaries 12–16, glabrous. Florets numerous; ray florets usually 12–17; ligule 7–15 mm long, rich magenta, occasionally pink or white, 4-veined. Achenes narrow-obloid, 2.5–3.2 mm long, brown or olivaceous, with papillose hairs forming lines. Pappus caducous, 5–7 mm long.

Notes: Native to South Africa. Occurs along the coastline; in south-western Western Australia from Perth south to Cape Leeuwin and east to Ledge Point east of Albany; in the south-east of Australia from Yorke Peninsula in south-eastern South Australia ESE to Orbost in south-eastern Victoria; and in Tasmania on the Bass Strait Is. and on the east coast. Grows in coastal sites on sand dunes and among rocks, in shrubland. Flowers mostly spring and summer.

Widespread along south-western and southern coastlines and readily recognised by virtue of its purple ligules and pinnatifid leaves. The capitula of *S. glastifolius* q.v. are similar but the shape of its leaves is very different. Hybrids between *S. elegans* and *S. pinnatifolius* have been recorded. Plants with paler or white ligules or doubled ligules have occasionally been recorded.

Representative specimens: WESTERN AUSTRALIA: Small unnamed lake/swamp 0.5 km north of Ledge Point, *A.E.Orchard* 5930 (HO, PERTH). SOUTH AUSTRALIA: Lower Coorong, 40 km south of Salt Ck, almost due west of Pitlockry Stn, *D.E.Symon* 10460 (AD, PERTH). VICTORIA: Pea Soup Shearwater Colony, Port Fairy, *J.C.Reid* 2184 (CANB, MEL). TASMANIA: South Arm, *A.Buchanan* 14278 (HO).

4. **Senecio glastifolius* L.f., *Suppl. Pl.* 372 (1782)

Type: Cape of Good Hope, South Africa, *Thunberg*; *n.v.*

Erect perennials to c. 1.5 m high, glabrous. Leaves oblanceolate to narrow-elliptic, to 12 cm long, with l:w ratio c. 2–4, lobate, with lobes antrorse; base hardly to moderately narrower; margin dentate or denticulate. Capitula few to numerous per stem; calycular bracteoles 10–16, 3–4 mm long, c. 0.8 mm wide; involucre c. 7 mm long, c. 5–8 mm diam.; phyllaries 20–22. Florets numerous; ray florets c. 13; ligule 10–20 mm long, 4-veined, pink to purple. Achenes narrow-obloid, 2.0–2.5 mm long, brown or olive-brown, with papillose hairs in narrow bands. Pappus caducous, c. 7 mm long. *Holly-leaved Senecio*.

Notes: Native to South Africa. Recorded from south-western Western Australia at Albany and Manjimup, and on the central coast of New South Wales at Bundeeena. Also naturalised in New Zealand. Grows in coastal sites on sand dunes and among rocks, in heathland and shrubland. Flowers spring–summer.

Representative specimens: WESTERN AUSTRALIA: SE slopes of Mt Adelaide, especially along Hare St, Albany, *G.J.Keighery* 8327 (AD, CANB, MEL, PERTH). NEW SOUTH WALES: south from Eric St, Bundecna, Central Coast, 29 Oct. 1999, *A.Horton s.n.* (NSW).

5. **Senecio tamoides* DC., *Prodr.* 6: 403 (1838)

Type: ‘Omsamwoubu’, southern Africa, *Drege*; holo: *G n.v.*; microfiche seen MEL

Climber to c. 2 m high, glabrous. Leaves to c. 12 cm long, with petiole c. half of length; lamina $\pm$ orbicular to ovate, with l:w ratio c. 1–1.5, with 1–3 lobes per side; margin entire or with a few denticulations. Capitula several to numerous per branch; calycular bracteoles 3–5, 1–1.5 mm long, c. 0.3 mm wide; involucre 7–8 mm long, c. 2.5 mm diam.; phyllaries 5–8. Florets 15–20; ray florets 3–6; ligule 10–20 mm long, 4-veined, yellow. Achenes not seen at maturity, glabrous. Pappus persistence unknown, 6–7 mm long.

Notes: Native to South Africa. Occurs in far south-eastern Queensland. Grows at margins of rainforest. Flowers autumn–winter.

An occasional garden escape. The relatively long corolla of the disc florets (corolla c. 10 mm compared to 5–7 mm long) and relatively small calycular bracteoles distinguish this species from *S. macroglossus* and *S. angulatus*.

Representative specimens: QUEENSLAND: Mt Glorious Rd just south of Mt Glorious village, near lower end of Bryce's Rd, *S.P.Phillips* 381 (BRI, MEL).

6. **Senecio macroglossus* DC., *Prodr.* 6: 404 (1838)

Type: Table Mountain, Cape of Good Hope, South Africa, *Zeyher*; syn: *n.v.*; ‘Zwarte Omsamcaba and Omsamcubo’, *Drege*; syn: *n.v.*; ‘Albany’, *Drege*; syn: *n.v.*

Climber to c. 3 m high, glabrous. Leaves to c. 6 cm long, with petiole c. half of length; lamina $\pm$ triangular, with l:w ratio 0.9–1.2, with a basal lobe on each side; margin entire or with small denticulations usually only near base. Capitula 1–3 per branch; calycular bracteoles 8–12, c. 10 mm long, c. 1.5 mm wide; involucre 9–11 mm long, c. 5 mm diam.; phyllaries c. 10. Florets numerous; ray florets c. 12; ligule 10–20 mm long, 8–10-veined, yellow. Achenes $\pm$ narrow-obloid, c. 2.5–3 mm long, pale-brown, glabrous. Pappus persistence unknown, 7–8 mm long. *Natal Ivy*, *Wax Vine*.

Notes: Native to South Africa. Occurs in south-eastern Queensland and in New South Wales near the coast. Grows in sandy soils in low coastal rainforest, woodland and mangroves. Flowers most of the year.

The triangular leaf-lamina, fewer and larger capitula and much larger bracteoles distinguish this species from *S. tamoides* and *S. angulatus*.

Representative specimens: QUEENSLAND: Boonooroo, *S.P. Phillips 601* (BRI). NEW SOUTH WALES: Sawtell, *B. Kemp 227* (MEL, NSW); near northern end of Grevillea Rd, off Tamarind Ave., Cudgen Nature Reserve, Bogangar, *J.R. Hosking 2023* (CANB, MEL, NE, NSW).

7. **Senecio angulatus* L.f., *Suppl. Pl.* 369 (1782)

Type: Cape of Good Hope, South Africa, *Thunberg*; *n.v.*

Scrambling or climbing plants to c. 3 m high, glabrous. Leaves to c. 10 cm long, with petiole c. half of length; lamina ovate, with l:w ratio c. 1–2, usually with 1–3 commonly obtuse lobes per side; margin entire or with a few denticulations. Capitula several to numerous per branch; calycular bracteoles 3–6, 1.5–2.5 mm long, c. 0.5 mm wide; involucre 5–6 mm long, c. 3 mm diam.; phyllaries 7–10. Florets 15–20; ray florets 3–6, mostly 5; ligule 8–12 mm long, 4-veined, yellow. Achenes narrow-obloid, 2.0–2.5 mm long, brown, with papillose hairs. Pappus caducous, 5–7 mm long.

Notes: Native to South Africa. Occurs in mesic parts of southern Australia, mostly in urban areas especially in the capital cities of southern states. Grows in various soils in shrubland and woodland in disturbed environments. Flowers late autumn–winter.

Similar to *Senecio tamoides* and *S. macroglossus* q.v. Also vegetatively similar to the discoid *Delairea odorata* q.v.

Representative specimens: WESTERN AUSTRALIA: Swan R., Sunset, Nedlands, *G.J. Keighery 13775* (PERTH). SOUTH AUSTRALIA: 4 km north of Palmer, *R. Bates 9898* (AD). NEW SOUTH WALES: east side of Carlisle Ave, Mt Druitt, *R.G. Coveny 16539* (MEL, NSW). VICTORIA: Red Bluff, Sandringham, *D.E. Albrecht 1838* (CANB, MEL). TASMANIA: No records seen. (Present in Tasmania *vide* A. Buchanan pers. comm.)

8. **Senecio crassiflorus* (Poir.) DC., *Prodr.* 6: 412 (1838)

Cineraria crassiflora Poir., *Encycl. suppl.* 2: 267 (1811).

Type: Buenos Aires, Brazil, *Commerson*; holotype: ?P (Herb. Lam.) *n.v.*, *vide* J.L.M. Poirét, *loc. cit.*

Sprawling subshrub forming mounds to c. 2 m high, densely appressed-woolly throughout. Leaves undivided, spatulate to oblanceolate, to c. 8 cm long, with l:w ratio c. 2–6; base attenuate; margin $\pm$ entire or distally crenulate or denticulate. Capitula 1–8 per branch; calycular bracteoles 3–6, 2–6 mm long, c. 1 mm wide; involucre 12–16 mm long, c. 10 mm diam.; phyllaries 20–22. Florets numerous; ray florets 12–22; ligule 15–30 mm long, 4-veined, yellow. Achenes narrow-obloid, 4–7 mm long, pale brown, strongly ribbed, with papillose hairs forming broad bands. Pappus caducous, 10–15 mm long.

Notes: Native to South America. Occurs in central and north-eastern New South Wales on the coast from Sawtell south to Cronulla. Grows on coastal dunes. Flowers most of year.

A silvery-grey plant grown as an ornamental and also once planted for coastal erosion control. Naturalised in a few places along the New South Wales coast.

Representative specimens: NEW SOUTH WALES: Sawtell Beach, 10 May 1967, *C.Burgess* (CANB).

9. **Senecio vulgaris* L., *Sp. Pl.* 2: 867 (1753)

Type: Europe, Herb. Clifford 406, *Senecio* 1A; lecto: BM, *fide* C.Jeffrey, *Regnum Veg.* 127: 87 (1993).

Annuals to c. 0.5 m high, glabrous except for cobwebby newer growth. Leaves commonly lobate to subpinnatisect, to 10 cm long, with l:w ratio c. 2–5; primary segments c. oblong to triangular; base auriculate, moderately stem-clasping; margin denticulate. Capitula discoid, several to many per stem; calycular bracteoles 8–16, 1.5–3 mm long, 0.4–0.6 mm wide; involucre 5–7 mm long, c. 2–3 mm diam.; phyllaries 13–22, glabrous. Florets numerous. Achenes narrow oblong-ellipsoid, 2.0–3.0 mm long, light brown, with papillose hairs in bands. Pappus caducous, 5–6 mm long.

Notes: Native to Europe. Occurs mostly in southern Australia in all capital cities and a few provincial cities. A widespread weed of cool-temperate regions. Grows mostly in urban environments, in garden beds and footpaths. Also occurring in orchards and occasionally invading woodland and forest. Flowers most of the year.

Differs from native discoid species by being a small annual, by having capitula with more numerous florets and phyllaries and calycular bracteoles that are conspicuously jet-black distally. Similar in habit and leaf shape to *S. glossanthus*, *S. halophilus* and *S. productus*, but in these native species the marginal florets are female and minutely ligulate, and the achenes are dimorphic.

Representative specimens: WESTERN AUSTRALIA: Western Australian Herbarium grounds, Kensington, Perth, *B.J.Lepschi* 1931 (CANB, MEL, PERTH). SOUTH AUSTRALIA: Mitcham, *R.V.Southcott* B1082 (AD, MEL). QUEENSLAND: Forest Hill, *M.Bodman* (BRI, NSW). NEW SOUTH WALES: Nashdale, Central Tablelands, *M.Dally* 2222 (NSW). AUSTRALIAN CAPITAL TERRITORY: CSIRO grounds, Black Mtn, Canberra, A.C.T., *M.Gray* 6229 (CANB). VICTORIA: corner of Pumps Rd and Axford Rd, Wantirna, *T.B.Muir* 6548 (MEL). TASMANIA: Hobart, 21 Jan. 1930, *F.H.Long* (HO).

Key to *Senecio*

- 1 Capitula discoid: all florets bisexual, or all florets female, and the corolla-limb of similar size in all florets, to 1.0 mm diam. at base of lobes OR capitula radiate but with only 1–3 ligules; achenes homomorphic
- 2 Annuals; calycular bracteoles pigmented black for 1/2 to 4/5 of length; phyllaries 14–23; florets > 40; corolla-limb shorter than tube ****S. vulgaris*** (see also H)
- 2: Perennial herbs or shrubs; calycular bracteoles not as extensively or darkly pigmented as above; phyllaries 7–13; florets < 40; corolla-limb c. equal to tube
- 3 Gynodioecious herbaceous perennials (plants female or hermaphrodite), not glaucous; achenes < 2 mm long (south-western W.A.) **C. Ramosissimus group**
- 3: Hermaphrodite shrubs or subshrubs, rarely herbaceous perennials, often glaucous; achenes > 2 mm long, or if less then unit inflorescences congested, corymbiform (not south-western W.A.)
- 4 Herbaceous perennials; apex of phyllaries mostly reflexed at anthesis **A. Disciform group**

- 4: Shrubs; apex of phyllaries erect or nearly so at anthesis..... **B. Odoratus group**
- 1: Capitula radiate or disciform: if disciform, the corolla-limb to 0.5 mm diam. at base of lobes, with corolla-limb of marginal florets significantly smaller than that of central florets; if radiate, ligules 4 or more, sometimes inconspicuous; achenes homomorphic or dimorphic
- 5 Capitula radiate with ligule < 2 mm long, or if ligule vestigial then female marginal florets in a clear minority and the corolla-tube shorter than the achene..... **F. Glossanthus group**
- 5: Capitula radiate with ligule > 2 mm long, OR disciform with a majority of florets female and the corolla tube longer than the achene
- 6 Capitula disciform..... **A. Disciform group**
- 6: Capitula radiate
- 7 Involucre < 5.5 mm long, < 3 mm diam., disc florets 8–30; calyular bracteoles 4–8; ligules 4–8..... **B. Odoratus group**
- 7: Capitula not entirely as above
- 8 Ligules purplish or rarely white and then inflorescences of several capitula, OR plants climbers with petiolate leaves and lamina with l:w ratio < 2, OR plants grey-woolly all over with entire leaves and ligules 15–30 mm long..... **H. Exotics**
- 8: Plants not as above
- 9 Plants not glaucous, seapiform or not, rhizomatous or not; calyular bracteoles 4–10 mm long, > 0.5 mm wide at mid-point, parallel-sided or nearly so, $\pm$ entirely herbaceous, or if ever shorter than 4 mm long, then leaves with an abrupt transition from a petiole to an undivided lanceolate lamina with margin serrulate..... **E. Maeranthus group**
- 9: Plants glaucous or not, not seapiform or rhizomatous (except in *S. pinnatifolius* var. *alpinus*); calyular bracteoles absent or 1–5 mm long, < 0.5 mm wide at mid-point, or if wider then not parallel-sided, $\pm$ entirely herbaceous or with a hyaline margin
- 10 Lower surface of leaves with a dense, closely appressed wool; calyular bracteoles 14–20..... ***S. pterophorus (H)**
- 10: Lower surface of leaves without a dense, closely appressed wool; calyular bracteoles 3–20
- 11 Biennials with plants a rosette of leaves in first season; stem leaves 2- or 3-pinnatisect, with venation of pinnae and pinnules raised on lower surface; capitula numerous per stem; achenes of ray florets glabrous but those of disc florets papillose-hairy..... ***S. jacobaea (H)**
- 11: Annuals or perennials with plants developing flowering stems in first season; stem leaves not entirely as above; capitula 1 to many; achenes of ray and disc florets not differing in indumentum as above
- 12 Plants glaucous or not; phyllaries fused or not, with stereome $\pm$ flat on drying; calyular bracteoles 0–4(–6); achenes various, sometimes lageniform, sometimes with pairs of ribs forming prominent ridges and with hairs restricted to the groove atop each ridge..... **D. Magnificus group**

- 12: Plants not glaucous; phyllaries not fused, with stereome commonly ridged basally on drying; calycular bracteoles 5 or more; achenes various, never lageniform, never with hairy ridges as above **G. Lautusoid group (including **S. madagascariensis*)**

A. Disciform Group (Capitula generally small, mostly disciform)

Terminology: The diameter of the involucre as given below is based on measurement at the junction of middle and upper thirds of the involucre in fresh material (a zone where diameter is fairly constant through developmental stages). Essentially the diameter is a reflection of the number of florets contained within the involucre. Although capitula are nearly cylindrical up until flowering, the basal half changes diameter progressively after flowering as achenes develop and capitula develop a conical shape. Pressed specimens can not reliably be used for this measurement, although measurement across the base of the involucre in only lightly pressed capitula at or slightly prior to anthesis gives a good approximation.

Lageniform achenes are achenes in which the tapering is such that the distal third is distinctly narrower than the proximal third, and so resembles a narrow bottle.

- 1 Mid to upper-stem leaves deeply pinnatisect, often approaching bipinnatisect, with pinnate segments in both distal and proximal halves, or if leaves a little less dissected then segments retrorse
- 2 Leaf segments retrorse; involucre 7.0–11.0 mm long..... **15. *S. ruiciniifolius***
- 2: Leaf segments not retrorse; involucre 3.5–7.0 mm long
 - 3 Stems ± glabrous; involucre length 3–4 times the diameter; phyllaries predominantly c. 8–10 **5. *S. bipinnatisectus***
 - 3: Stems sparsely to densely coarse-hairy; involucre length 2–3 times the diameter; phyllaries predominantly c. 12–14
 - 4 Leaves coarse-hairy; achenes 1.5–2.0 mm long, with papillose hairs ± scattered. **8. *S. bathurstianus***
 - 4: Leaves glabrous or with hairs on mid-rib only; achenes 2.0–2.7 mm long, with papillose hairs in bands **7. *S. esleri***
- 1: Mid- to upper-stem leaves less dissected than above and segments not retrorse
 - 5 All or most capitula comprising 7–10 phyllaries
 - 6 Leaves glabrous or nearly so on both surfaces (margin may have some short hairs)
 - 7 Plants erect; taproot well-developed; mid-stem leaves commonly antrorsely lobate; phyllaries 4.5–6.5 mm long; achenes oblong-ellipsoid ... **2. *S. diaschides***
 - 7: Plants sprawling; taproot inconspicuous; mid-stem leaves entire or with spreading teeth; phyllaries 6.0–8.0 mm long; achenes narrowly lageniform..... **30. *S. psilophyllus***
 - 6: Leaves with fine and/or coarse hairs on one or both surfaces
 - 8 Plants lacking coarse hairs; stems and lower surface of leaves with a somewhat dense indumentum of fine hairs **19. *S. quadridentatus***

- 8: Plants with coarse hairs (sometimes only base coarse and evident as tubercle-like projections) or if not, then indumentum not as above
- 9 Upper-stem leaves scabridulous on upper surface due to coarse hair-bases, woolly on lower surface, with the wool overlying coarse basal portion of hairs (Queensland/New South Wales border).....25. *S. scabrellus*
- 9: Upper-stem leaves not entirely as above
- 10 Leaves not dissected or with only 1 or 2 segments per side; leaf-margins not crowded-denticulate; base of leaves above mid stem not or hardly amplexicaul, with auricles entire, or small, or absent.
- 11 Secondary roots fleshy and usually slightly tuberiform; lower stem bearing spreading coarse hairs; achenes narrowly lageniform, 2.8–4.0 mm long.....29. *S. preanthoides*
- 11: Secondary roots slightly to moderately fleshy but not tuberiform; lower stem appressed-cottony or near glabrous, stem not developing coarse hairs; achenes not or indistinctly lageniform, 2.0–2.8 mm long
- 12 Leaves often with prominent basal lobes > 2 mm long; papillose hairs rather sparse, usually recessed in deep grooves.....26. *S. tenuiflorus*
- 12: Leaves without basal lobes, or lobes < 2mm long; papillose hairs ± crowded in bands in shallow grooves.....24. *S. microbasis*
- 10: Leaves regularly dissected, with 3–6 segments per side or not dissected but then margin crowded-denticulate; base of leaves above mid stem somewhat amplexicaul, with auricles well-developed, usually toothed or lobed
- 13 Coarse hairs rather sparse; leaves usually not dissected, with sinuses typically < 25% of distance to midrib.....1. *S. minimus*
- 13: Coarse hairs scattered to moderately dense; leaves dissected with sinuses typically > 25% of distance to midrib
- 14 Stems and lower surface of leaves often intensely purple; segments of leaves roughly semicircular in outline and with margin crowded-denticulate; uppermost leaves clearly broadest at auricles.....4. *S. picridioides*
- 14: Stems and lower surface of leaves mostly green, sometimes slightly to moderately purple; segments of leaves not as above; uppermost leaves broadest at auricles or not
- 15 Mid- to upper-stem leaves with coarse hairs on both surfaces, cobwebby overlay not conspicuous; phyllaries predominantly 11–13, or if rarely predominantly 9–10 then achenes red-brown, < 2.2 mm long, and segmentation of mid to upper-stem leaves confined to proximal two-thirds.
- 16 Apex of phyllaries without purple pigmentation; achenes red-brown.....9. *S. hispidulus*
- 16: Apex of phyllaries with purple pigmentation; achenes tan or light brown.....10. *S. hispidissimus*
- 15: Mid- to upper-stem leaves as above or one or both surfaces ± glabrous or with a conspicuous cobwebby overlay; phyllaries predominantly 8–10, or if sometimes predominantly 11 or 12 then achenes 3–4 mm long, pale olive-brown, glabrous

- 17 Leaves with roughly triangular segments restricted to proximal 50–60% of leaf; achenes 3.0–4.0 mm long, pale olive-brown, glabrous.....28. *S. niveoplauus*
- 17: Leaves with triangular, oblong or obovate segments and primary dissection extending into distal third of leaf; achenes 2.0–3.0 mm long, brown and with papillose hairs or red-brown with very fine papillose hairs
- 18 Secondary roots dominant; leaves with the continuous medial band of lamina (see fig. 2) roughly oblong and the distal centimetre commonly with an oblong section 2–8 mm long; achenes with a l:w ratio of c. 4–5, reddish-brown, with fine hairs in lines or somewhat scattered (montane 6. *S. distalilobatus*
- 18: Primary root dominant; leaves with the continuous medial band of lamina somewhat elliptic and the distal cm roughly triangular; achenes with a l:w ratio of c. 6–7, brown, with plump papillose hairs crowded in bands (coastal, occasionally montane).....3. *S. biserratus*
- 5: All or most capitula comprising (11–) 13–25 phyllaries
- 19 At least lower stem region developing coarse spreading hairs (which are sometimes partly obscured by overlying wispy extensions), these hairs sometimes becoming lost with age.
- 20 Involucre < 2.0 mm in diameter at junction of middle and upper thirds (unpressed); phyllaries 3.0–6.5 mm long or to 9 mm long but then achenes markedly bottle-shaped (neck 0.3–1.0 mm long); achenes with papillose hairs sparse to dense, forming lines or bands clearly narrower than ribs
- 21 Secondary roots at least as stout as the slender indistinct taproot, distinctly fleshy and commonly slightly tuberiform; achenes lageniform, 2.8–4.5 mm long, with papillose hairs short (with l:w ratio c. 1–2), and sparse to scattered in lines narrower than the ribs 29. *S. preuauthoides*
- 21: Secondary roots finer than the stout taproot, hardly fleshy and not tuberiform; achenes obloid, 1.0–2.2 mm long, with papillose hairs longer than above (with l:w ratio c. 3), scattered to dense in lines or bands
- 22 Peduncle and lower capitulum not cobwebby at anthesis; calycular bracteoles 4–8.....9. *S. hispidulus*
- 22: Peduncle and lower capitulum cobwebby to woolly at anthesis; calycular bracteoles 6–12.....12. *S. glomeratus**
- 20: Involucre mostly > 2.0 mm in diameter at junction of middle and upper thirds (unpressed); phyllaries 4.0–12.0 mm long; achenes not or only minutely lageniform, with papillose hairs rather dense, forming bands of similar width to than ribs
- 23 Upper-stem leaves without auricles or leaves clearly broadest at mid-leaf and with auricles hardly stem-clasping; phyllaries mostly to 15, rarely c. 18; apex of phyllaries usually with a conspicuous black tip and without a zone of purple pigmentation; achenes commonly minutely lageniform
- 24 Involucre 8.5–10 mm long.....34. *S. oldfieldii*
- 24: Involucre 5–8 mm long

- 25 Coarse hairs on leaves often 1–2 mm long, usually numerous on uppermost leaves 33. *S. longipilus*
- 25: Coarse hairs on leaves to c. 1 mm long, sparse or absent on uppermost leaves 32. *S. uigrapicus*
- 23: Upper-stem leaves usually auriculate, often broadest at the auricles and with auricles weakly to strongly stem-clasping; phyllaries up to 25; apex of phyllaries with black tip absent or inconspicuous and commonly with a zone of purple pigmentation c. 0.5–1 mm long; achenes narrow-obloid
- 26 Uppermost leaves and inflorescence bracts with long coarse hairs typically numerous on the margin; capitula 1.8–2.5 mm diam.; achenes generally tan to light brown..... 10. *S. hispidissimus*
- 26: Uppermost leaves and inflorescence bracts with coarse hairs usually absent or few; capitula 2.0–4.0 mm diam.; achenes brown or red-brown or often some achenes blackish
- 27 Taproot poorly developed; involucre 6–11 mm long, 2.8–4.0 mm diam.; phyllaries (12–) 16–25 36. *S. squarrosus*
- 27: Taproot usually well-developed; involucre 5–8 mm long, 2.0–2.8 mm diam.; phyllaries 12–14 11. *S. multicaulis**
- 19: Stems glabrous or only developing appressed fine hairs
- 28 All florets in a capitulum bisexual and $\pm$ identical in shape with all corollalimbs 5-lobed, or disciform with up to c. half of florets female with 4-lobed corollas (in c. 1 marginal series); apex of phyllaries typically strongly reflexed at least on drying
- 29 Leaves glabrous.....38. *S. interpositus*
- 29: Leaves densely woolly on one or both surfaces
- 30 Leaves densely woolly on both surfaces; inflorescence branchlets, peduncles and bracts densely woolly; calycular bracteoles > 4 mm long.....40. *S. helichrysoides*
- 30: Leaves densely woolly on lower surface only, inflorescence branchlets, peduncles and bracts sparsely woolly; calycular bracteoles < 4 mm long.....39. *S. georgianus*
- 28: At least 2/3 of florets in a capitulum female (in c. 2–3 marginal series), with the corolla 2–4-lobed; apex of phyllaries usually not strongly reflexed
- 31 Plants glabrous or nearly so on all parts; leaves elliptic, with a l:w ratio of c. 2–4, often lobed; margin of leaves denticulate or dentate, with apex of lobes and teeth acuminate; involucre 4.0–5.0 mm long..... 14. *S. lacertus*
- 31: Plants variously hairy or nearly glabrous; leaves not entirely as above; involucre 5.0–13.0 mm long
- 32 Achenes lageniform, 2.0–7.0 mm long
- 33 Stems creeping before arching to erect; leaves in basal third of stem to 8 cm long, markedly broader than mid-stem leaves; lower surface of leaves green, lacking coarse hairs and nearly glabrous (sub-alpine)..... 31. *S. lageniformis*
- 33: Stems $\pm$ erect from base; leaves not entirely as above (lowland to montane)

- 34 Unit inflorescences of few to c. 10 capitula; involucre > 3.0 mm diam.; calycular bracteoles > 3.0 mm long, commonly divergent; achenes with papillose hairs in bands covering > 40% of surface, with l:w ratio of hairs c. 4 37. *S. macrocarpus*
- 34: Unit inflorescences of several to many capitula; involucre < 3.0 mm diam.; calycular bracteoles < 3.0 mm long, appressed; achenes with papillose hairs in lines or bands covering < 40% of surface, with l:w ratio of hairs c. 1–2
- 35 Phyllaries < 8 mm long
- 36 Plant branching all along primary stem at anthesis; primary stem leaves with 1 or 2 near-basal teeth per side19. *S. glabrescens*
- 36: Plant not branching along primary stem at anthesis except from upper axils; primary stem leaves lacking near-basal teeth
- 37 Plants with taproot distinctly stouter than the slightly fleshy secondary roots; at anthesis capitula and peduncles ± glabrous or if cobwebby then lower stems cottony to woolly also; marginal achenes commonly red
- 38 Plants with mature stems and lower surface of mature leaves not or hardly obscured by indumentums.....22. *S. queenslandicus*
- 38: Plants with mature stems and lower surface of mature leaves somewhat obscured by indumentums.....20. *S. quadridentatus*
- 37: Plants with taproot inconspicuous, not stouter than the distinctly fleshy secondary roots; at anthesis, capitula and peduncles cobwebby to woolly but lower stems ± glabrous; marginal achenes not red
- 39 Involucre 5–7(–7.5) mm long; achenes 2.5–4.0 mm long, with neck 0.5–1 mm long.....18. *S. campylocarpus*
- 39: Involucre > 7 mm long; achenes 4.0–6.0 mm long, with neck 1–2 mm long.....16. *S. longicollaris*
- 35: Phyllaries > 8 mm long
- 40 Plants with taproot inconspicuous, not stouter than the distinctly fleshy secondary roots; mid-stem leaves with l:w ratio < 12; capitula cobwebby but mid-stem region ± glabrous at anthesis 16. *S. longicollaris*
- 40: Plants with taproot distinctly stouter than the slightly fleshy secondary roots; mid-stem leaves with l:w ratio > 12 (excluding any lobes); capitula cobwebby or not at anthesis but if so then mid-stem region also cobwebby
- 41 Leaves in lower third of stems ± lacking coarse hairs, linear to narrow-linear, and similar through middle third 20. *S. quadridentatus*
- 41: Leaves in lower third of stems with scattered coarse hairs, oblanceolate to narrow-oblanceolate, becoming wider spaced,

- obviously narrower and without coarse hairs through middle third
- 42 Achenes 5–7 mm long (Tasmania) 17. *S. tasmanicus*
- 42: Achenes 3–4 mm long (semi-arid regions of south-eastern Australia) 21. *S. dolichocephalus*
- 32: Achenes obloid or oblong-ellipsoid, 1.5–3.0 mm long
- 43 Capitula with involucre 1–1.5 mm diam. (mature receptacle 1–2 mm diam.) and florets 12–25
- 44 Leaves often with spreading basal lobes > 2 mm long; papillose hairs rather sparse, usually recessed in deep grooves 26. *S. tenuiflorus*
- 44: Leaves without basal lobes, or lobes < 2mm long; papillose hairs ± crowded in bands in shallow groove..... 24. *S. microbasis*
- 43: Capitula with involucre 1.6–3 mm diam. (mature receptacle 2–6.5 mm diam.) florets 26–60
- 45 Achenes glabrous or hairs occasional in narrow grooves
- 46 Plants typically growing in water; involucre 2.3–2.8 mm diam.; achenes glabrous, with ribs ± flat..... 35. *S. psilocarpus*
- 46: Plants not typically growing in water; involucre 1.5–2.0 mm diam.; achenes glabrous or sparsely papillose-hairy, with ribs flat to convex
- 47 Mid-stem leaves undivided and linear or with 1 or 2 lobes per side confined to proximal half (altitudes below montane)..... 26. *S. tenuiflorus*
- 47: Mid-stem leaves undivided and narrowly elliptic or with lobes or teeth extending into distal half of leaf (montane to alpine)
- 48 Plants commonly greyish; leaves above mid-stem usually not divided (although often denticulate to dentate), if ever lobate then lobes spreading to slightly antrorse; calycular bracteoles to 2.0–3.5 mm long; achenes 2.5–4.0 mm long, olive-brown 27. *S. gunnii*
- 48: Plants mostly greenish; leaves above mid-stem lobate, with lobes moderately antrorse; calycular bracteoles to (2.0–) 3.0–5.0 mm long; achenes 2.0–2.2 mm long, red-brown 13. *S. extensus*
- 45: Achenes with moderately to very dense narrow to broad bands of papillose hairs
- 49 Base of mid- to upper-stem leaves sagittate due to shape of auricles, or base without auricles; calycular bracteoles 3–5, 1.0–2.0 mm long 23. *S. phelleus*
- 49: Base of mid- to upper-stem leaves not sagittate, with small auricles usually present; calycular bracteoles 6–10, 1.0–5.0 mm long
- 50: Calycular bracteoles generally c. half of length of involucre bracts; achenes with bands of hairs narrower than adjacent surfaces (sub-alpine) 13. *S. extensus*
- 50: Calycular bracteoles generally a quarter to a third of length of involucre bracts; achenes with bands of hairs c. as broad as adjacent surfaces (low altitudes)

- 51 Plants with taproot inconspicuous, not stouter than the distinctly fleshy secondary roots; involucre 6–11 mm long, 2.8–4.0 mm diam.; phyllaries (12–) 16–25.....36. *S. squarrosus*
- 51: Plants with taproot usually distinctly stouter than the slightly fleshy secondary roots; involucre 5–8 mm long, 2.0–2.8 mm diam.; phyllaries 12–14 11. *S. multicaulis**

Subspecies of *S. multicaulis

- Length: width ratio of mid to upper-stem leaves (excluding auricles) mostly > 6; lower surface glabrous or indumentum sparse to moderate; involucre 5–8 mm long, length:diam. ratio c. 2.5–3.5 subsp. *multicaulis*
- Length: width ratio of mid to upper-stem leaves (excluding auricles) mostly < 6; lower surface moderately to densely woolly; involucre 4–6 mm long, length:diam. ratio 2.0–2.5 subsp. *stirlingensis*

Subspecies of *S. glomeratus

- Achenes < 1/3 of phyllary length (phyllaries 4.0–6.0 mm long; achenes 1.0–1.7 mm long), commonly all medium to dark red-brown; pappus usually > 5 mm long subsp. *glomeratus*
- Achenes > 1/3 of phyllary length (phyllaries mostly 3.0–5.0 mm long; achenes 1.3–2.2 mm long), with marginal ones greenish or olive, and central ones medium brown; pappus usually < 5 mm long subsp. *longifructus*

B. Odoratus Group (Often glaucous; capitula small, discoid or radiate and then capitula with 4–8 ligules)

1 Capitula radiate

- 2 Plants extensively rhizomatous; inflorescences of 1–5 capitula; involucre appressed-woolly 9. *S. behrianus*
- 2: Plants not extensively rhizomatous; inflorescences usually of 20 or more capitula; involucre glabrous
- 3 Leaves with l:w ratio 1.5–3, with base strongly cordate, with lower surface densely woolly 10. *S. garlandii*
- 3: Leaves not entirely as above 8. *S. linearifolius**

1: Capitula discoid

- 4 Leaves ± glabrous, lobate to deeply pinnatisect with 2–6 strongly antrorse lobes/segments per side; reticulate venation obscure; short appressed wool absent
- 5 Leaves deeply pinnatisect, sometimes bipinnatisect, segment axes with l:w ratio > 10 1. *S. aethiifolius**
- 5: Leaves lobate to subpinnatisect, segment axes with l:w ratio < 5
- 6 Leaves fleshy, lobes/segments commonly c. oblong; phyllaries predominantly 8–10, 4.5–6 mm long (south-eastern Western Australia) 2. *S. euclausis*
- 6: Leaves not fleshy, lobes usually triangular; phyllaries predominantly 11–13, 5–8 mm long (south-central South Australia) 3. *S. gawlereensis*
- 4: Leaves glabrous or variously indumented, not divided (margins may be toothed), or if lobate then involucre, peduncles and often younger stems and leaves with a

short appressed wool; reticulate venation of leaves sometimes distinct on one or both surfaces

7 Leaves to 15 mm wide; margins entire or if denticulate or dentate then involucre lanate; reticulate venation of leaves not apparent

8 Mid-branch leaves l:w < 10, margins of all or most leaves $\pm$ crowded-denticulate to dentate, sometimes lobate, rarely most leaves $\pm$ entire; auricles if present often bidentate; calycular bracteoles to 3 mm long, with l:w ratio mostly > 3; at anthesis, peduncles and capitula patchily to densely woolly, rarely $\pm$ glabrous; florets per capitulum 10–18 4. *S. lanibracteus*

8: Mid-branch leaves l:w > 7, margins entire, revolute, auricles if present not divided; calycular bracteoles to 2 mm long, with l:w ratio mostly <2; at anthesis, peduncles and capitula glabrous or less often patchily woolly; florets per capitulum 8–12 (–14).....5. *S. cunninghamii**

7: Leaves to 50 mm wide; commonly $\pm$ crowded-denticulate or dentate; reticulate venation of leaves apparent on one or both surfaces; involucre glabrous

9 Plant not glaucous; mid-branch leaves tapering strongly to a petiole-like proximal portion 1–4 cm long, auricles absent or small, upper surface green, lower surface $\pm$ completely obscured by a $\pm$ appressed indumentums.....6. *S. hypoleucus*

9: Plant often glaucous; mid-branch leaves not tapering strongly to a petiole-like proximal portion, auricles commonly well-developed and usually moderately stemelapsing; lower surface mostly glabrous or sparsely indumented, rarely moderately obscured by a loosely appressed indumentums.....7. *S. odoratus*

*Subspecies of *S. anethifolius*

Plants not glaucous, or rarely slightly glaucous; segments of leaves very fine (of major branches mostly 0.8–2.0 mm wide; of secondary branches mostly 0.3–0.8 mm wide, dried); calycular bracteoles (1.5–) 2.0–5.0 mm long; involucre 5.0–8.5 mm long; resin ducts of phyllaries and bracteoles fine, not raised; corolla-lobes mostly 1.0–1.6 mm long (dried).....subsp. *anethifolius*

Plants glaucous at least on newer growth; segments of leaves generally broader than above (of major branches mostly 1.5–3.5 mm wide, of secondary branches mostly 0.6–1.5 mm wide, dried); calycular bracteoles 0.5–2.0 mm long; involucre 3.5–6.0 (–7.0) mm long; resin ducts of phyllaries and bracteoles commonly broad and often raised; corolla-lobes mostly 0.6–1.0 mm long (dried).....subsp. *brevibracteolatus*

*Varieties of *S. cunninghamii*

Length:width ratio of mid-branch leaves (of longer branches) 15–40; peduncles and capitula glabrous, often glaucous at and before anthesis.....var. *cunninghamii*

Length:width ratio of mid-branch leaves (of longer branches) 7–15 (–20); peduncles and capitula patchily woolly before anthesis, lost or persistent at anthesis, not glaucous.....var. *flindersensis*

Varieties of *S. linearifolius

- 1 Lower surface of mature leaves woolly, with surface largely to entirely obscured; leaves lacking auricles or auricles present only on uppermost leaves and very small and entire; achenes with papillose hairs
- 2 Hairs of lower surface of leaves basally coarse, multicellular and spreading; florets per capitulum 20–30 var. *grauiticola*
- 2: Hairs of lower surface of leaves entirely fine; florets per capitulum 16–20 var. *gariwerdeensis*
- 1: Lower surface of mature leaves glabrous or slightly to moderately cobwebby, with surface only slightly obscured; leaves often with prominent and/or divided auricles; achenes glabrous or with papillose hairs
- 3 Upper-stem leaves with l:w ratio mostly < 10; involucre 3.5–5.5 mm long; achenes glabrous, or if not then lower surface of leaves strongly glaucous or younger growth moderately woolly/cobwebby
- 4 Plants not glaucous; lower surface of leaves slightly to moderately obscured by mostly cobwebby hairs, new growth ± densely woolly var. *arachnoideus*
- 4: Plants usually glaucous; lower surface of leaves glabrous or hairs coarse, spreading with cobwebby extensions weakly developed, new growth not woolly
- 5 Leaves mostly dentate, commonly with hairs on lower surface, mildly glaucous or occasionally not glaucous; achenes glabrous var. *macrodonatus*
- 5: Leaves entire to denticulate, glabrous, strongly glaucous; achenes with papillose hairs var. *daugarensis*
- 3: Upper-stem leaves with l:w ratio various; involucre 2.5–4 (–5) mm long; achenes with papillose hairs
- 6 Plant usually at least slightly glaucous; lower surface of leaves usually with scattered, spreading, rather weak multicellular hairs, glabrescent var. *intermedius*
- 6: Plant not glaucous; lower surface of leaves glabrous or hairs not as above
- 7 Margin of stem leaves entire or appearing so, (minute callus points sometimes developed but these projecting medially due to revolute margin); l:w ratio of upper-stem leaves (5–) 10–30 var. *linearifolius*
- 7: Margin of stem leaves not entire, callus-denticulate, denticulate or dentate; l:w ratio of upper-stem leaves 1.5–10 (–15)
- 8 Mid to upper-stem leaves less than 25 mm wide and with l:w ratio > 4; leaf-base attenuate to cuneate, with basal segments hardly fused with lamina; callus-denticulate or denticulate, with points variably crowded (mostly 1–3 per cm) var. *denticulatus*
- 8: Mid to upper-stem leaves more than 25 mm wide, or if narrower then l:w ratio < 4 and/or with leaf-base broad-cuneate to truncate or cordate; basal lobes commonly broadly fused with lamina; denticulate to dentate to slightly serrate, with points commonly moderately crowded (c. 3–5 per cm) var. *latifolius*

C. Ramosissimus Group (Capitula small, not radiate, or with ligules few and white or pink)

- 1 Capitula radiate, with 1–3 small pink or white ligules 1. *S. leucoglossus*
- 1: Capitula discoid
 - 2 Plants $\pm$ glabrous; leaves undivided, with margin crowded-denticulate; inflorescence narrow-pyramidal (lateral capitula/clusters terminating well below medial capitulum/cluster) 3. *S. ramosissimus*
 - 2: Plants conspicuously hairy on stems and/or leaves; leaves divided or not, with margin not crowded-denticulate; inflorescence not narrow-pyramidal
 - 3 Leaves pinnatisect; lower surface of leaves appressed-woolly; capitula 4–5 mm long; phyllaries not recurved 2. *S. gilbertii*
 - 3: Leaves undivided or lobate; lower surface of leaves glabrous or with coarse hairs on veins; capitula c. 7 mm long; phyllaries strongly recurved 4. *S. barkhausioides*

D. Magnificus group (Often glaucous; capitula large, radiate; calycular bracteoles absent or few; mostly arid or semi-arid)

- 1 Leaves linear, with margin entire; calycular bracteoles absent; all or most phyllaries $\pm$ seamlessly fused to adjacent phyllaries for more than half their length at anthesis (splitting later into 3 or 4 sections); pappus to 30 mm long
 - 2 Ray florets 5 (–7); achenes 2/3–3/4 of length of phyllaries; achenes 5–10 mm long, with papillose hairs c. 0.3 mm long; pappus 5–17 mm long at maturity 5. *S. conferruiniatus*
 - 2: Ray florets 7–11; achenes c. 1/2 of length of phyllaries; achenes 4–8.5 mm long, with papillose hairs c. 0.6–1.0 mm long; pappus 10–30 mm long at maturity 4. *S. gregorii*
- 1: Leaves not as above; calycular bracteoles present or not; all phyllaries free or fusion less complete than above at anthesis; pappus < 12 mm long
 - 3 Annuals; leaves not divided, to 4 cm long; phyllaries fused in groups 6. *S. gypsicola*
 - 3: Annuals, perennials or shrubs; leaves divided or not, to 12 cm long; phyllaries usually all free
 - 4 Annuals perennials or shrubs to 1.8 m high; usually slightly to strongly glaucous; outermost tubular florets 5–9 mm long; achenes not lageniform
 - 5 Inflorescences of 1–5 capitula; phyllaries 10–15 mm long; ligules 12–20-veined; achenes 5–7.5 mm long 7. *S. megaglossus*
 - 5: Inflorescences of 3–30 capitula; phyllaries 5–11 mm long; ligules 4–13-veined; achenes 2–6 mm long
 - 6 Calycular bracteoles 3–6; achenes 4–5 mm long, with pairs of ribs forming prominent ridges, long hairs arising only from grooves along summit of ridges; pappus persistent 9. *S. pilosicristus*
 - 6: Calycular bracteoles 0–4; achenes not with ridges and indumentum as above, or if so then achene < 4 mm long and pappus caducous

- 7 Leaves strongly stem-clasping; inflorescences commonly with more than 20 capitula; achenes 2–4 mm long, with hairs confined to grooves along summit of ridges, pappus caducous, c. 5 mm long 10. *S. velleioides*
- 7: Leaves hardly stem-clasping; inflorescences commonly with less than 20 capitula; achenes 3–7 mm long, not indumented and ridged as above; pappus persistent, > 6 mm long 8. *S. magnificus*
- 4: Annuals to 0.5 m high; not glaucous; outermost tubular florets 4–6 mm long; achenes lageniform or not
 - 8 Leaf-segments lobate, with lobes moderately crowded; leaves often with scattered long hairs, somewhat caducous; achenes not tapered distally, densely hairy, with hairs long 1. *S. platylepis*
 - 8: Leaf-segments entire or lobes well-spaced; leaves usually glabrous or nearly so; achenes lageniform, with granular papillae
 - 9 Leaves dentate to deeply lobate, axis of segments to 15 mm long; phyllaries glabrous; achenes largely covered throughout by whitish papillae 3. *S. murrayanus*
 - 9: Leaves lobate-pinnatisect, axis of segments to 40 mm long; phyllaries with a few coarse hairs; achenes with sparse to moderately dense often translucent papillae, often sparser on neck 2. *S. tuberculatus*

E. Macranthus Group (Capitula large, radiate; calycular bracteoles narrow-oblong; most species in areas of moderate to high rainfall)

- 1 Larger leaves all or mostly cauline at anthesis; most leaves above mid-stem > 3 cm long (lowland to montane)
 - 2 Plants extensively rhizomatous; pappus 12–20 mm long (lowland plains) 4. *S. daltonii*
 - 2: Plant not extensively rhizomatous; pappus 5–10 mm long (hills and mountains)
 - 3 Stem leaves with l:w ratio 1–4, deeply pinnatisect proximally (branch leaves may be undivided and then margin with occasional teeth); phyllaries with pigmented hairs or not; ligules 7 (–8) nerved 1. *S. vagus**
 - 3: Stem leaves with l:w ratio 3–25, undivided, with margin entire or crowded-denticulate; phyllaries glabrous; ligules 4- or 5- (or rarely to 7-) nerved
 - 4 Leaves linear, gradually tapering to base; phyllaries 18–22 2. *S. macranthus*
 - 4: Leaves with an abrupt transition from petiole to lamina, with lamina narrow-elliptic; phyllaries 12–16 3. *S. anygdalifolius*
- 1: Larger leaves all or mostly basal at anthesis; all leaves/bracts above mid-stem < 3 cm long (mostly montane to alpine)
 - 5 Leaves hairy; stem leaves/bracts up to 5 (excluding distalmost 1 cm of stem)
 - 6 Basal leaves ± sharply demarcated into petiole and blade, usually at least some > 15 mm wide; upper surface lacking broad-based coarse hairs; lower surface with secondary venation raised, conspicuous; capitula 1–4 9. *S. primulifolius*
 - 6: Basal leaves spatulate, < 15 mm wide; upper surface with broad-based coarse septate hairs to c. 1.5 mm long (or their stout residual bases); lower surface with inconspicuous secondary venation; capitulum 1 8. *S. papillosus*
 - 5: Leaves ± glabrous; stem leaves/bracts 5–15 (excluding distalmost 1 cm of stem)

- 7 Leaves deeply lobate to pinnatisect, with 3–6 c. oblong segments per side, concolorous or nearly so; inflorescence of a solitary capitulum; ligules yellow 7. *S. pectinatus**
- 7: Leaves not divided or lobate, with 1–several serrations or c. triangular lobes per side, markedly discolorous; inflorescences of 1 or more capitula; ligules yellow, white, or cream
- 8 Leaves 4–10 mm wide, with teeth or lobes 3 or more per side; inflorescences mostly of 3 or more capitula; ligules yellow 5. *S. leptocarpus*
- 8: Leaves 1–4 mm wide, with teeth 1 or 2 per side; inflorescences of a solitary capitulum; ligules white or cream 6. *S. albogilvus*

Subspecies of *S. vagus

- Margin of leaves, peduncle and margin of calycular bracteoles with coarse hairs; phyllaries with pigmented coarse hairs; achenes usually glabrous subsp. *vagus*
- Margin of leaves, peduncle and margin of calycular bracteoles glabrous or nearly so; phyllaries glabrous; achenes usually with hairs in lines along ribs subsp. *eglandulosus*

Varieties of *S. pectinatus

- Rosette leaves 1–5 (–8) cm long, with medial zone of unbroken lamina not or only slightly increasing in width distally, 1–2 (–4) mm wide at widest; calycular bracteoles (4–) 5–6.5 mm long; involucre 6–9 mm long, 8–15 (–20) mm wide at widest point when pressed var. *pectinatus*
- Rosette leaves (3–) 4–15 cm long, with medial zone of unbroken lamina clearly broadening distally and generally > 4 mm wide in at least some leaves; calycular bracteoles 6–10 mm long; involucre 8–12 mm long, 15–30 mm wide at widest point when pressed var. *major*

F. Glossanthus Group (Capitula small; capitula radiate with rays inconspicuous or capitula disciform; achenial dimorphism in most species)

- 1 Achenes all similar in length; attachment points on receptacle not dimorphic as below; corolla-tube of female florets distinctly longer than the mature achene 4. *S. serratiflorus**
- 1: Achenes of female florets longer than those of bisexual florets; attachment points on receptacle for achenes of female florets thickened and usually projecting (in contrast to attachment points for bisexual achenes); corolla-tube of female florets shorter than or equal to the mature achene
- 2 Phyllaries 12 or 13 in a majority of capitula; female florets 8–13; achenes of female florets 3–6 mm long, slightly lageniform 2. *S. productus**
- 2: Phyllaries 7–10, or occasionally to 13, in a majority of capitula; female florets predominantly 4–8; achenes of female florets 2–3.5 mm long, not lageniform
- 3 Involucre 3.5–6 mm long; calycular bracteoles 0.2–0.5 mm wide; mature receptacle 1–2 (–2.5) mm diam.; ligules generally exceeding involucre; hairs on achenes of bisexual florets < 0.15 mm long, barely exceeding pappus ring 1. *S. glossanthus*

- 3: Involucre 5–7 mm long; calycular bracteoles 0.5–1 mm wide; mature receptacle mostly 2–3.5 mm diam.; ligules not exceeding involucre; hairs on achenes of bisexual florets > 0.2 mm long, clearly exceeding pappus ring.....3. *S. halophilus*

Subspecies of *S. proiluctus

Ligule vestigial; achenes of female florets < 4.5 mm long subsp. *productus*

Ligule c. 1 mm long; achenes of female florets > 4.5 mm long subsp. *magnus*

Subspecies of *S. serratifornis

Mid-stem leaves with l:w ratio < 7; margin with several to many serrations; involucre 7–8 mm long..... subsp. *serratifornis*

Mid-stem leaves with l:w ratio > 7; margin subentire or few-toothed; involucre 6–7 mm long..... subsp. *stenophyllus*

G. Lautusoid Group (Capitula radiate; rays mostly 8–13; calycular bracteoles several to many, ovate to lanceolate)

- 1 All or most capitula in an inflorescence with phyllaries c. 13 or c. 20 and number of ligules several fewer than number of phyllaries, i.e. ligules 8–10, phyllaries 13; ligules c. 13, phyllaries c. 20 (arid, semiarid or mesic environments)
- 2 Stem and major branch leaves commonly undivided, sometimes with a few lobes per side; leaf margin with frequent often minute marginal points per side (often difficult to ascertain in pressed material); phyllaries mostly c. 20; achenes 1.5–2.2 mm long, 0.3–0.5 mm diam..... 11. *S. madagascariensis*
- 2: Stem and major branch leaves divided or not; leaf margin with few to numerous marginal points per side, but if numerous then leaves generally markedly serrate, lobate or pinnatisect; phyllaries mostly c. 13 or mostly c. 20; achenes (1.8–) 2.0–5.0 mm long, 0.5–0.8 mm diam.
- 3 Lower surface of leaves often with numerous somewhat persistent coarse hairs or hair-bases; calycular bracteoles with intense purple pigmentation in distal half to one third; achenes of ray florets c. 1 mm longer than those of disc florets and with a much broader carpoidial ring (Perth region and Busselton, Western Australia) 1. *S. eudylus*
- 3: Lower surface of leaves commonly glabrous or nearly so, sometimes occasional long hairs persistent; calycular bracteoles with pigmentation usually not as intense and/or extensive as above; ray achenes not dimorphic as above or if ever approaching this degree of dimorphism, then only the distal quarter or less of calycular bracteoles pigmented (widespread)
- 4 Phyllaries usually > 5.0 mm long and mature achenes of ray florets > 3.0 mm long; achenes of ray florets slightly longer than those of disc florets; attachment zones on receptacle for achenes of female florets more prominent than those for achenes of disc florets
- 5 Phyllaries mostly c. 20; ligules mostly c. 13 (central Australia between latitudes 22° and 27°) 8. *S. eremicola*

- 5: Phyllaries mostly c. 13; ligules mostly c. 8; (arid southern Australia south of latitude 26°) 9. *S. lacustrinus*
- 4: Phyllaries < 5.0 mm long and/or mature ray achenes < 3.0 mm long, or if phyllaries and achenes slightly longer then achenes or receptacle not as above
- 6 Annuals, not developing bark on lower stems and taproot; leaves pressing thin; margin of mid-stem leaves with several to numerous denticulations/teeth per side; in dried specimens paler involuere commonly contrasting with a brown to dark-brown receptacle (in some or most capitula) (southern Queensland and adjacent eastern parts of Northern Territory and South Australia)
- 7 Phyllaries mostly 13 (and ligules c. 8), occasionally phyllaries mostly c. 18; achenes 1.6–2.5 mm long; achenes of female florets with surface fully obscured by coarse papillose hairs, with these hairs strongly overtopping pappus-ring (L. Eyre basin, far south-western Queensland, north-eastern South Australia, also eastern Northern Territory) 7. *S. depressicola*
- 7: Phyllaries mostly c. 18–22 (and ligules c. 13); achenes 2.5–3.0 mm long; achenes of female florets with surface partly obscured by fine hairs, with these hairs hardly overtopping pappus-ring (semiarid to arid south-eastern to south-central Queensland) 6. *S. brigalowensis*
- 6: Perennials (commonly), with bark developing on lower stems and major branches and taproot; leaves pressing thin or somewhat fleshy; margin of stem/major branch leaves with 0–2 (–4) denticulations/teeth per side; in dried specimens involuere and receptacles similar in colour or if contrasting as above then marginal points on mid-stem (mid-branch) leaves few per side (north-western and south-eastern Australia)
- 8 Leaves not fleshy, pressing thin, above mid-branch tapering to subpetiolate basally; margin of leaves entire (Hamersley Ra. and environs and Cape Ra., Western Australia) 10. *S. hamersleyensis*
- 8: Leaves often slightly fleshy, pressing thin or thick, above mid-branch often very narrow but generally not tapering basally; margin of leaves entire or with denticulations (southern and eastern Australia)
- 9 Mid-branch leaves 2–3-pinnatisect (including leaves with only single lobes on primary segments) 4. *S. pinnatifolius**
- 9: Mid-branch leaves (entire or) 1-pinnatisect
- 10 Segments of leaves narrow-linear to filamentous (l:w ratio generally > 20 and/or segments < 0.5 mm wide); narrow basal segments often arising from a narrow rachis; calycular bracteoles often purple-tipped (under magnification) (hills, often rocky sites) 4. *S. pinnatifolius**
- 10: Segments of leaves mostly narrow-oblong to narrow-linear (l:w ratio generally < 20 and larger segments > 0.5 mm wide); narrow basal segments not developed except from a broadened rachis; calycular bracteoles not purple-tipped (semi-arid plains) 5. *S. spanouernus*
- 1: All or most capitula in an inflorescence with number of phyllaries c. 13, and number of ligules similar (semiarid or mesic environments)
- 11 Leaves very fleshy, to 5 cm long; involuere 5–11 mm long; broader stereomes to 3.0 mm wide, not ridged on drying; achenes 3.0–7.0 mm long; pappus usually persistent (coastal or near coastal dunes)

- 12 Undivided leaves with l:w ratio < 4 (rachis of divided leaves with l:w ratio < 15); margin of leaves usually serrate or serrulate; calycular bracteoles not or hardly overlapping at anthesis; achenes glabrous or variously hairy (eastern Australia) 2. *S. spathulatus**
- 12: Undivided leaves with l:w ratio > 4 (rachis of divided leaves with l:w ratio > 15); margin of leaves entire or nearly so; calycular bracteoles overlapping at anthesis; achenes densely hairy (south-western Western Australia) 3. *S. warreneusis*
- 11: Leaves thin to fleshy, to 15 cm long; involucre 3–8 mm long; broader stereomes to 1.5 mm wide, commonly ridged on drying; achenes 1.6–4.5 mm long; pappus mostly caducous (habitat various)
- 13 Outer phyllaries with hyaline margin slender but distinct (> 0.1 mm wide) under low magnification in proximal 2/3 of phyllary 4. *S. piuuatifolius**
- 13: Outer phyllaries with hyaline margin hardly developed (to c. 0.1 mm wide) in proximal 2/3 of phyllary
- 14 Plants with taproot usually poorly to moderately developed; undivided leaves or rachis of divided leaves of major branches variously shaped; segments 0–6 per side, arising up to 80% of the way along leaves, variously shaped, with margin entire or variously toothed or lobed (Choose leaves in middle third of major branches) 4. *S. piuuatifolius**
- 14: Plants developing a stout taproot; undivided leaves or rachis of divided leaves always more or less narrow-linear; segments (0–) 1 or 2 (–3) per side, generally not arising beyond 60% of the way along leaves, narrow-oblong to narrow-linear and with margin quite entire (Choose leaves in middle third of major branches)
- 15 Segments of leaves narrow-linear to filamentous (l:w ratio generally > 20 and/or segments < 0.5 mm wide); narrow basal segments often arising from a narrow rachis; calycular bracteoles often purple-tipped (under magnification) (hills, often rocky sites) 4. *S. piuuatifolius**
- 15: Segments of leaves mostly narrow-oblong to narrow-linear (l:w ratio generally < 20 and larger segments > 0.5 mm wide); narrow basal segments not developed except from a broadened rachis; calycular bracteoles not purple-tipped (semi-arid plains) 5. *S. spauomerus*

*Varieties of *S. spathulatus*

- 1 Mid-branch leaves usually tapering somewhat basally (width 3 mm from base commonly $< 1/3$ of the maximum width); achenes $\pm$ densely hairy var. *attenuatus*
- 1: Mid-branch leaves not tapering or tapering slightly basally (width 3 mm from base commonly $> 1/3$ of the maximum width); achenes glabrous or sparsely to moderately hairy
- 2 Achenes 4.0–7.0 mm long, c. 0.8–1.2 mm diam., straw coloured to pale brown, glabrous, rarely with scattered hairs (eastern Victoria, far south-eastern New South Wales) var. *latifructus*
- 2: Achenes 3.0–5.5 mm long, c. 0.5–0.8 mm diam., sparsely to moderately hairy or glabrous, surface golden or dark brown (Tasmania) var. *spathulatus*

*Varieties of *S. pinnatifolius*

- 1 Leaves bi- or tri-pinnatisect; stems succulent; capitula and leaves rather crowded; ligules not or hardly longer than involucre in pressed specimens (Bass Strait Is.).....var. *capillifolius*
- 1: Leaves not bi-pinnatisect, or if so then stems not or hardly succulent, capitula and leaves crowded or lax; ligules generally distinctly longer than involucre in pressed specimens
- 2 Distal portion of stereome of inner phyllaries more than twice as broad as stereome of outer phyllaries (both measured c. 1 mm below apex), usually bordered by a purple chevron (distinct under low magnification); margins of outer phyllaries c. as broad as the stereome 1 mm below apex; tap-root generally poorly developed (south-eastern mostly south of latitude 35°30S).....var. *lanceolatus*
- 2: Distal portion of stereome of inner phyllaries not bordered by a purple chevron, or only faintly bordered, generally less than twice as broad as that of outer phyllaries (both measured c. 1 mm below apex); margin of outer phyllaries narrower than stereome 1 mm below apex; tap-root often well-developed (widespread)
- 3 Calycular bracteoles 10–16, broad-ovate to ovate, > 0.8 mm wide at mid-point and length less than twice the width at mid-point, largely hyaline; apex of stereome of inner phyllaries commonly with a faint chevron (south-western Western Australia)..... var. *latilobus*
- 3: Calycular bracteoles 6–12, ovate to lanceolate, either < 0.8 mm wide at mid-point or length more than twice the width at mid-point, usually predominantly herbaceous; chevron generally absent
- 4 Leaves thin, markedly discolorous; marginal points, mostly as serrulations, generally 15 or more per side; upper-branch leaves with base not narrower than mid-leaf (forests of northern New South Wales and southern Queensland) var. *serratus*
- 4: Leaves usually somewhat fleshy and or succulent, not or only slightly discolorous; marginal points fewer than 15 per side, or if more then upper-branch leaves with base narrower than mid-leaf (widespread).
- 5 Plants often rhizomatous, with aerial stems $\pm$ unbranched; leaves oblanceolate in outline and/or marginal points and segments clearly more numerous beyond mid-leaf; usually both peduncle and margin of calycular bracteoles moderately pubescent (montane to alpine regions)..... var. *alpinus*
- 5: Plants not rhizomatous, with stems generally branched; leaves not as above or if so then not peduncle and margin of bracteole not both pubescent
- 6 Leaves crowded, fleshy, 1–2 cm long; achenes c. 4 mm long, with surface completely obscured by hairs (Western Australia)..... var. *leucocarpus*
- 6: Leaves various; achenes < 4 mm long or if longer then surface clearly visible (distribution various)
- 7 Leaves generally only slightly fleshy, pressing fairly thin; leaves often developing straplike basal segments from a narrow rachis; rachis of upper-branch leaves generally narrower than stem at base; achenes to 4.5 mm long, usually e. half to two-thirds of the length of phyllaries var. *pinnatifolius*
- 7: Leaves fleshy, pressing thick, and often coarsely wrinkled; leaves not developing straplike basal segments from a narrow rachis; rachis of

upper-branch leaves often as broad as or broader than stem at base; achenes to 3 mm long, generally less than half the length of phyllaries

- 8 Sprawling to prostrate plants; length:width ratio of rachis of leaves mostly 1–10; hairs of achenes of ray florets exceeding pappus-ring (southern coast, including western Tasmania)..... var. *maritimus*

- 8: Erect plants; length:width ratio of rachis of leaves 6–50; hairs of achenes of ray florets not exceeding pappus-ring (Western Australia)..... var. *pinnatifolius*

H. Exotic Species

- 1 Erect annuals to c. 0.5 m high; capitula discoid 9. *S. vulgaris*

- 1: Annuals or perennials, erect or not, sometimes climbing, to c. 3 m high; capitula radiate

- 2 Scrambling or climbing plants; leaves (excluding uppermost leaves) with a petiole-like portion comprising nearly half of its length, abruptly widening into an undivided or lobate lamina $\leq$ twice as long as broad

- 3 Basal lateral lobes of leaves with apex acute, margin of leaves entire or nearly so between basal lobes and apex; inflorescences of 1–3 capitula; calycular bracteoles c. 10 mm long; ray florets c. 12 6. *S. macroglossus*

- 3: Basal lateral lobes of leaves with apex acute to rounded; margin of leaves usually dentate or lobed between basal lobes and apex; inflorescences mostly of 10 or more capitula; calycular bracteoles 1–3 mm long; ray florets 3–6

- 4 Corolla of disc florets 9–12 mm long 5. *S. tamoides*

- 4: Corolla of disc florets 5–6 mm long 7. *S. angulatus*

- 2: Plants habit not as above; leaves not entirely as above

- 5 Ligule white, pink or purple

- 6 Leaves usually lobate with lobes/segments not dilated distally; calycular bracteoles < 1 mm wide; phyllaries 20–22 4. *S. glastifolius*

- 6: Leaves pinnatisect with primary segments dilated distally; calycular bracteoles > 1 mm wide; phyllaries 12–16.....3. *S. elegans*

- 5: Ligule yellow

- 7 Plants grey, woolly throughout; leaves entire; involucre 12–16 mm long 8. *S. crassiflorus*

- 7: At least part of plants green; leaves usually toothed or deeply dissected; involucre 3.5–5 mm long

- 8 Leaves dentate, sometimes appearing entire; lower surface $\pm$ completely obscured by a close, dense indumentum; calycular bracteoles 14–20; phyllaries 18–22 1. *S. pterophorus*

- 8: Leaves pinnatisect, lower surface not or slightly obscured by hairs; calycular bracteoles 3–6; phyllaries 11–13.....2. *S. jacobaea*

10. *Erechtites* Raf., *Fl. Ludov.* 65 (1817).

Annuals or perennial herbs. Leaves sessile, with veins pinnate. Capitula disciform, pedunculate, calyculate; phyllaries free. Florets: corolla-limbs greenish-white or

pinkish. Anthers not known. Style-branches recurved; apex with a short conical appendage. Achenes oblong-ellipsoid. Pappus caducous.

A genus of six species, all native to the New World.

**Erechtites valerianifolius* (Wolf) DC., *Prodr.* 6: 295 (1838) forma *valerianifolius*.

Senecio valerianifolius Wolf, *Ind. Sem. Hort. Berol.* (1825), as *valerianaefolius*.

Type: cult, '*Senecio valerianaefolius* ex Herb. Raffelliano, 1825', Herb. Reichenbach f. 16256; neo: W, *fide* R.O. Belcher, *op. cit.* 26.

Annuals to c. 2 m high. Hairs rather sparse on mature stems, peduncles and leaves. Leaves to c. 20 cm long, with l:w ratio c. 2–3, usually deeply lobed to pinnatisect, petiole-like basally, margin serrate. Capitula numerous per stem; mature peduncle to c. 20 mm long; calycular bracteoles 6–10, linear, 1.5–3 mm long; involucre 7–10 mm long, 2–3 mm diam.; phyllaries c. 12–14; stereome flat, with 4 or 5 resin ducts; mature receptacle with pits raised, concave. Florets numerous; corollas c. 8 mm long, exceeding phyllaries by c. 1–2 mm, with basal cone much elongated, c. 0.3 mm diam., with limb 1/4–1/3 of total length, very narrow-obconical, pink, usually pale yellow when dry. Style-branches purple. Achenes narrowly oblong-ellipsoid, 2.5–4 mm long, with c. 10 narrow convex ribs, pale brown, darker in grooves, with scattered hairs in grooves. Pappus 8–12 mm long, pink; bristles minutely and sparsely scabrid-barbellate. *Brazilian Fireweed*.

Notes: Native to Central and South America, but widespread as a weed. Occurs in far south-eastern Queensland south to the Sydney region in central-eastern New South Wales. Grows in disturbed sites in mesic environments, including forests. Flowers mostly summer–autumn.

Erechtites valerianifolius is similar to the Australian disciform species of *Senecio*, but has lyrate divided leaves, raised receptacular pits, corolla-bases tapering very gradually upwards from the base, different style-branch morphology, and a pink pappus. It is occasionally confused with the sometimes sympatric *Crassocephalum crepidioides*.

Representative specimens: QUEENSLAND: Utchee Ck, *D.R. Bailey 50* (BRI); Near Brummys Lookout, SE of Tyalgum, *A.R. Bean 14559* (BRI). NEW SOUTH WALES: Tooloom Falls, *N.S. Lander 322* (BRI, NSW); Lanc Cove National Park, *M. Gray 5209* (CANB).

11. *Crassocephalum* Moench, *Methodus* 516 (1794).

Annual herbs. Leaves sessile, pinnately veined. Capitula discoid (in Australia) or radiate, pedunculate, calyculate; phyllaries free or rarely fused. Florets: corolla-limbs variously coloured. Anthers ecaudate. Style-branches angled upwards; apex crowned with papillae, with a long tapering terminal appendage. Achenes homomorphic, obloid. Pappus caducous.

A genus of c. 40 species native to Arabia, tropical Africa and Madagascar.

**Crassocephalum crepidioides* (Benth.) S. Moore, *J. Bot.* 50: 211 (1912)

Gynura crepidioides Benth., in W.J. Hooker, *Niger Fl.* 438 (1849).

Type: Sierra Leone, *G. Don*; lecto: BM, *fide* A.J.C. Grierson in M.D. Dassanayake & F.R. Fosberg (eds) *Revis. Haudb. Fl. Ceylon* 1: 248 (1980).

Annual herbs to c. 1.2 m high. Hairs moderately dense on most parts except leaves. Leaves to 20 cm long, with l:w ratio mostly c. 2–3, undivided or lobate to pinnatisect in proximal half; base petiole-like or sub-basal segments present, margins irregularly serrate. Inflorescence of few–several discoid capitula (capitula nodding at anthesis); mature peduncle to c. 40 mm long; calycular bracteoles 8–12, narrow-linear, 2–5 mm long; involucre 8–12 mm long, 3–5 mm diam.; phyllaries commonly c. 16, sparsely pubescent, glabrescent; stereome $\pm$ flat, with 1 or 2 inconspicuous resin ducts, with coarse hairs or glabrous; mature receptacle with pits strongly elevated. Florets numerous; corolla c. 10 mm long, exceeding phyllaries by 2–3 mm, with base c. 0.2 mm diam, with limb c. 2/5 of total length, very narrow-obconical, orange to reddish-brown (drying pink); style-appendage purple. Achenes oblong-ellipsoid, 2.0–2.3 mm long, with c. 10 narrow convex ribs, purple, with scattered hairs in grooves. Pappus 8–14 mm long; bristles minutely and sparsely scabrid-barbellate. *Thickhead*.

Notes: Native to tropical Africa. Occurs in eastern Queensland south from Mt Mulligan in the far north to the Queensland/New South Wales border, and in eastern New South Wales extending as far south as Wollongong. A widespread weed extending from India ESE through South-east Asia to northern Australia. Grows in predominantly disturbed and cultivated sites in various soils in woodland, forest, and grassland. Flowers most of year.

Crassocephalum crepidioides has raised receptacular pits identical to those seen in *Erechtites valerianifolius*. These two species have often been confused; however, they are easily distinguished by the colour of the pappus, and their leaf morphology is significantly different. Phylogenetic studies using molecular data by Pelter *et al.* (2002) show *Crassocephalum* and *Erechtites* to be closely related and this corresponds to the closeness in receptacle morphology seen in naturalised species of each genus in Australia.

Representative specimens: QUEENSLAND: Amys Peak, Kroombit Tableland, c. 60 km SW of Gladstone, *M.D.Crisp* 2847 (CANB, BRI); creek behind Cannon Park Racecourse, Cairns City, *R.L.Jago* 4244 (BRI, DNA, MEL). NEW SOUTH WALES: Tweed R., Duranbah, *H.S.McKee* 11651 (CANB); Formerly Ring's property, above Mt Keira Scout Camp, c. 8 km west of Wollongong, *P.C.Jobson* 4305 (BRI, CANB, NSW).

12. *Arrhenechthites* Mattf., *Bot. Jahrb. Syst.* 69(2): 288 (1938)

Erect, perennial herbs. Leaves sessile, pinnately veined. Capitula disciform, pedunculate, calyculate; phyllaries free. Florets: outer florets with corolla zygomorphic (in Australia) with a rudimentary ligule; central florets functionally male (not in Australia) or bisexual, with corolla-limbs yellow or tinged purple. Anthers caudate. Style-branches erect, with apex truncate or obtuse, crowned with papillae, without terminal appendage. Achenes homomorphic, narrow-obloid. Pappus caducous.

A genus of five species from New Guinea and Australia. The single species in Australia is endemic. The genus is characterised by the functionally male central florets with short, astigmatic style-branches with papillose-hairy outer faces (Beleher 1956). In some instances, however, the Australian species has been found to have bisexual central florets.

Arrhenechthites mixtus (A.Rich.) Belcher, *Ann. Missouri Bot. Gard.* 43: 75 (1956), as *mixta*.

Senecio mixtus A.Rich., in J.S.C.Dumont d'Urville, *Voy. Astrolabe* 2: 112 (1834);

Erechtites mixtus (A.Rich.) DC., *Prodr.* 6: 297 (1838), as *mixta*.

Type: Port-Jackson [most likely collected from the Blue Mtns to the west of Port Jackson], New South Wales, *C.Gaudichaud-Beaupré*; holo: P.

Plants to c. 0.9 m high, with fleshy subtuberos roots, with scattered hairs; hairs multicelled, pale or purplish basally, terminating in a long fine whitish portion that is soon lost. Leaves often somewhat abruptly broadening from petiole-like to broad-laminate, to 12 cm long, with l:w ratio c. 3–5, lobate to pinnatisect, with degree of dissection reducing distally, with 3–9 segments per side; base often with 1 or 2 narrow segments; margin entire or with a few denticulations or teeth; lamina $\pm$ glabrous except for short coarse hairs on or near margins (but new growth briefly cobwebby); secondary venation evident; abaxial surface purple. Capitula few to c. 20 per stem; mature peduncle mostly to c. 50 mm long; calycular bracteoles 3–6, 4.0–6.0 mm long, 0.4–0.6 mm wide; involucre 12–20 mm long, 2–3 mm diam.; phyllaries 7–10, flat, glabrous or hairy. Florets 10–15; outer florets 8–10, with a pale yellow or purplish, irregularly deeply and peracutely lobed ligule c. 1 mm long. Achenes narrow obloid, 6–8 mm long, prominently ribbed, glabrous. Pappus c. 12 mm long. *Purple Fireweed*.

Notes: Occurs in south-eastern Australia from Mt Spirabo in north-eastern New South Wales south to eastern Victoria. Grows on soils of various derivation including granite, greywacke, quartzite and conglomerate, in open forest, at moderate altitudes (to 1560 m). Flowers mid-spring–late summer.

Arrhenechthites mixtus is a peculiar species which was originally described as a *Senecio*, then transferred to *Erechtites*, and finally transferred to *Arrhenechthites*, an otherwise entirely New Guinean genus in 1956. It differs from other species of *Arrhenechthites* in having inflorescences with fewer capitula, sometimes bisexual central florets, outer florets with a more pronounced ligule, markedly longer fruits and capitula, leaves intensely purple on the abaxial surface, and pigmented multicellular hairs on the phyllaries. This casts some doubts as to its suitability to be classified in *Arrhenechthites*, and ultimately *A. mixtus* may be best placed in a genus of its own. The phylogeny of tribe Senecioneae is currently under investigation using molecular data (Pieter Pelser pers. comm.), and initial findings using plastid and nuclear (ITS region) data indicate that *Arrhenechthites mixtus* is most closely related to *Arrhenechthites novoguineensis*, *Dendrocacalia crepidifolia* and *Senecio thapsoides*. The clade formed by these species is sister to a clade comprising species of *Erechtites*, *Crassocephalum* and many species of *Senecio* (*Senecio sensu stricto*).

Morphologically, *A. mixtus* resembles *Gynerium drymophila* in phyllary and fruit morphology, but its style-branch morphology is significantly different. Curiously, it combines features of two Australian species of *Senecio* with which it more or less sympatric. It resembles the radiate species *Senecio vagus* subsp. *vagus* in leaf morphology and by having similar pigmented multicellular hairs, and it resembles the disciform species *S. prenanthoides* in terms of leaf pigmentation, its slender capitula, low numbers of florets per capitulum, and its subtuberos secondary roots. The minutely ligulate female florets could also be interpreted as being intermediate in morphology between these species.

Representative specimens: NEW SOUTH WALES: 12 km south of Tantawangalo, south of Chalkhills Fire Trail, Tantawangalo State Forest, *I.Crawford* 2255 (CANB, MEL, NSW).

VICTORIA: Fork Track area, between Tulach Ard Rd and Snowy R. Gorge, *A.C.Beauglehole* 37347 (MEL; 2 sheets).

13. *Emilia* Cass., *Bull. Sci. Soc. Philom. Paris* 68 (1817).

Annual to perennial herbs. Leaves sessile, pinnately veined. Capitula discoid (in Australia), or radiate, pedunculate, ecalyculate; phyllaries free. Florets: corolla-limbs pink, red, sometimes yellow. Anthers ecaudate. Style-branches with apex truncate to obtuse, crowned with papillae, with or without terminal appendage. Achenes homomorphic, narrow-obloid. Pappus caducous.

A genus of c. 100 species in Africa south of the Sahara, Asia and the Pacific Is. The hyaline margin of the phyllaries of species of *Emilia* in Australia are narrow and of similar width on all phyllaries in contrast to most other species in the Senecioneae in Australia which exhibit dimorphism in margin width.

Key to species

Developing stems not densely hairy; leaves often with lateral segments; upper-stem leaves strongly cordate or sagittate; corolla with limb 2–3.5 mm long, pale purple, not reaching to apex of phyllaries or exceeding them by up to 2 mm; achenes 2.2–3.8 mm long..... **1. *E. souchifolia***

Developing stems densely hairy; leaves lacking lateral segments; upper-stem leaves not strongly cordate or sagittate; corolla with limb 4–5 mm long, brick-red, exceeding phyllaries by 2–4 mm; achenes 4.0–5.0 mm long **2. *E. fosbergii***

1. **Emilia souchifolia* (L.) DC., in R.Wight, *Contr. Bot. India* 24 (1834)

Cacalia souchifolia L., *Sp. Pl.* 2: 835 (1753).

Type: Sri Lanka, Herb. Hermann; BM *u.v.*, *fide* A.J.C.Grierson in M.D.Dassanayake & F.R.Fosberg (eds), *Revis. Handb. Fl. Ceylon* 1: 252 (1980).

Annuals to c. 0.5 m high. Hairs sparse, mainly on stems and leaves, glabrescent. Leaves to c. 8 cm long, with l:w ratio c. 2–4, undivided or sometimes lobate to pinnatisect, sometimes petiole-like with lamina much broader distally; margin dentate; upper-stem leaves becoming lanceolate, auriculate. Inflorescences of 1–several capitula; mature peduncle to c. 80 mm long; ecalyculate; involucre 7–12 mm long, 2–4 mm diam.; phyllaries c. 6–8; stereome flat, with 3–5 resin ducts, with a few coarse hairs or glabrous; receptacular pits not or very slightly raised. Florets c. 30; corolla 6–10 mm long, slightly below, equal to or exceeding involucre by up to 2.5 mm, with base c. 0.3 mm diam., with limb 1/3–2/5 of total length, narrow-obconical, pink; style-branch appendage purple. Achenes narrow-obloid, 2.2–3.8 mm long, with 5 broad $\pm$ flat ribs, brown or straw-coloured, with scattered hairs in grooves. Pappus 5–8 mm long; bristles minutely scabrid-barbellate.

Notes: Aberrant, probably diseased plants have been collected that develop green inflorescences characterised by several vegetative shoots developing from capitula instead of florets (the so-called ‘hen and chicken’ effect). There are two varieties.

Apex of phyllaries with dark border to c. 1 mm long or absent; corolla 1 mm shorter than or up to 1 mm longer than phyllaries; corolla-lobes < 1 mm long; achenes 2.2–3.2 mm long..... var. *souchifolia*

Apex of phyllaries commonly with dark border 2–3 mm long; corolla usually exceeding phyllaries by up to 2.5 mm; corolla-lobes > 1 mm long; achenes 3.0–3.8 mm long..... var. *javanica*

****Emilia sonchifolia* (L.) DC. var. *sonchifolia***

[*Emilia purpurea* auct. non Cass. (1825); F.Mueller, *Fragm.* 12: 21 (1882)]

Capitula: length of involucre commonly > 2.5 times diameter mid-involucre; apex of phyllaries without a dark border or border to c. 1 mm long; stercome often with scattered coarse hairs especially distally. Corolla 1 mm shorter than or up to 1 mm longer than phyllaries, with lobes < 1 mm long. Achenes 2.2–3.2 mm long.

Notes: Probably native to southern Asia. Occurs in northern Western Australia, northern Northern Territory, and in northern and eastern Queensland, predominantly on or near the coast. A widespread weed of tropical regions. Grows in moist, sandy soils eg. cays, sand dunes, and in grassland. Flowers mostly autumn–winter.

The most reliable character distinguishing this variety from var. *javanica* is the length of the corolla lobes. Subtle differences are also apparent in capitular proportions, and var. *sonchifolia* commonly has scattered hairs on the distal half of phyllaries, whereas var. *javanica* almost always has glabrous phyllaries.

Representative specimens: WESTERN AUSTRALIA: Mitchell Plateau mining camp, P.A.Fryxell 4013 & L.A.Craven (MEL). NORTHERN TERRITORY: Little Lagoon, Groote Eylandt, R.L.Specht 419 (CANB); Kakadu National Park, C.R.Dunlop 8562 & P.F.Munns (CANB, DNA, MEL). QUEENSLAND: Red Beach, Weipa area, K.Herrman s.n. (CANB); Beames St, Mareeba, J.R.Clarkson 4594 (DNA, PERTH, QRS).

****Emilia sonchifolia* var. *javanica* (Burm.f.) Matf., *Bot. Jahrb. Syst.* 62: 445 (1929)**

Hieracium javanicum Burm.f., *Fl. Indica* 174, t. 57, fig. 1 (1768); *Prenanthes javanica* (Burm.f.) Willd., *Sp. Pl.* 3: 1534 (1803); *Sonchus javanicus* (Burm.f.) Spreng., *Syst. Veg.* 3: 648 (1826); *E. javanica* (Burm.f.) C.B.Rob., *Philipp. J. Sci.*, C 3: 217 (1908).

Type: Java, *Garcin* s.n.; holo: G n.v., *fide* D.H.Nicolson, *op. cit.* 399 (1980)

Capitula: length of involucre < 2.5 times the diameter mid-involucre; apex of phyllaries commonly with a dark border 2–3 mm long; stercome usually glabrous; corolla usually exceeding phyllaries, by up to 2.5 mm, with lobes > 1 mm long. Achenes 3.0–3.8 mm long.

Notes: Native to eastern Asia and the western Pacific. Occurs in eastern Queensland and north-eastern New South Wales. Grows mostly in sandy soils in coastal dunes, also in woodland and forest. Flowers mostly autumn–winter.

Representative specimens: QUEENSLAND: Bruce Hwy, 12 km south of Mackay, A.R.Bean 16271 (BRI); Brisbane, 4 Dec. 1938, H.Tryon (BRI). NEW SOUTH WALES: Kingscliff, North Coast, R.G.Coveny 12437, W.Bishop & L.J.Murray (NSW).

2. **Emilia fosbergii* Nicolson, *Phytologia* 32: 33 (1975)

Type: Bahamas, New Providence, near Nassau, 26 Dec. 1902, Curtiss 6; holo: US n.v., *fide* D.H.Nicolson, *loc. cit.*

Annuals to 0.5 m high. Transiently densely coarse-hairy on new growth. Leaves to c. 8 cm long, with l:w ratio c. 2–4, undivided, margins dentate, base becoming truncate to auriculate upwards. Capitula solitary or few; mature peduncle to c. 80 mm long; involucre 7–12 mm long, 3–7 mm diam.; phyllaries c. 6–8, glabrous; stereome flat, with 3–5 resin ducts; receptacular pits not or slightly raised. Florets c. 30 to numerous; corolla 7–11 mm long, exceeding involucre by 2–4 mm, with base c. 0.4 mm wide, with limb c. 1/2 of total length, very narrow-campanulate, purple-red; style-appendage purple. Achenes obloid, with 5 broad $\pm$ flat ribs, 4–5 mm long, ribs brown or stramineous, scattered short papillose hairs in grooves. Pappus 5–8 mm long.

Notes: Possibly native to Africa. Occurs in far north-eastern Queensland. Naturalised across the Pacific region. Ecological preferences not known. Flowers mostly autumn–winter.

First recorded for Australia in 1997 when collected from Lockhart River.

Representative specimens: QUEENSLAND: Vicinity of Lockhart R. township, J.F.Grimshaw JFG 697C (BRI, DNA, MEL).

14. *Gynura* Cass., *Dict. Sci. Nat.* 34: 391 (1825), *nom. cons.*

Annual or perennial herbs. Leaves sessile, pinnately veined. Capitula discoid, pedunculate, calyculate; phyllaries free. Florets: corolla-limbs yellow, orange, red, purplish, white or greenish. Anthers ecaudate. Style-branches $\pm$ erect, with apex truncate, without crown of papillae, with terminal appendage long, tapering. Achenes homomorphic, narrow-obloid. Pappus persistence not known.

A genus of c. 40 species occurring in Asia and Africa with most species in southeast Asia.

Gynura drymophila (F.Muell.) F.G.Davies, *Kew Bull.* 35(4): 733 (1980)

Senecio drymophilus F.Muell., *Trans. & Proc. Philos. Inst. Victoria* 2: 69 (1857).

Type: Brisbane River, Queensland, Oct. 1856, Hill & F.Mueller (MEL); lecto: K *n.v.*, *fide* P.I.Forster & A.Thongpukdee, *Austrobaileya* 2(5): 560 (1988); iso: MEL.

Succulent, tuberous rooted herbs to c. 0.5 m high. Coarse-hairy on most parts, or glabrous. Leaves mostly oblanceolate, to 15 cm long, with l:w ratio c. 3–5, entire, denticulate, or lobate; base weakly to strongly auriculate. Capitula few to several; mature peduncle to c. 50 mm long; calycular bracteoles 4–8, linear, 6–10 mm long; involucre 10–15 mm long; phyllaries c. 13; stereome flat, with resin ducts obscure, with coarse hairs or glabrous; receptacular pits slightly raised. Florets numerous; corolla 8–14 mm long, exceeding involucre by c. 3–4 mm, with base c. 0.6 mm wide, with limb c. 1/3 of total length, yellow to orange-red; style-branch appendages yellowish. Achenes narrow oblong-ellipsoid, 5–8 mm long, with c. 10 narrow convex ribs, dark brown, glabrous. Pappus c. 10 mm long; bristles minutely and sparsely scabrid-barbellate.

Notes: The broad succulent roots of this species are distinctive. There are two varieties.

Plants with spreading, coarse hairs var. *drymophila*
Plants glabrous var. *glabrifolia*

Gynura drymophila* (F.Muell.) F.G.Davies var. *drymophila

Senecio shirleyanus Domin, *Biblioth. Bot.* 89: 686 (1929).

Type: Tambourine Mts, Queensland, Mar. 1910, *K.Domin 9143 & 9144*; syn: PR *n.v.*, *fide* R.O.Belcher, *Kew Bull.* 44(3): 533 (1989).

[*Gynura pseudochina* auct. non (L.) DC.; G.Bentham, *Fl. Austral.* 3: 661 (1867)]

Plants with spreading multicellular hairs on stems, leaves, peduncles, bracts, bracteoles and phyllaries.

Notes: Occurs in Queensland extending from Lizard Island in the far north of the state south to the MacPherson Ranges; also in far northern New South Wales as far south as Ballina. Grows on sandstone among granite boulders, and in near coastal lowland situations, on cliff tops, and in rocky and sandy sites in woodland, forest, vine thicket, closed heath, vine forests, and hoop pine rainforest. Flowers all year round.

Representative specimens: QUEENSLAND: 1 km NW of L. Elphinstone outlet, Carborough Ra., *I.R.Telford 11120 & R.J.Rudd* (BRI, CANB, NSW); Mt Walsh, 6 km south of Biggenden, *M.D.Crisp 2635* (BRI, CANB, NSW). NEW SOUTH WALES: Mt Nullam, Sept. 1896, *W.Bauerlen* (NSW).

***Gynura drymophila* var. *glabrifolia* P.I.Forst. & Thongp., *Austrobaileya* 2(5): 564 (1988)**

Type: cultivated specimen ex 2 km SW of Boolbunda Rock, Queensland, 15 May 1986, *P.I.Forster 2425*; *holo:* BRI.

Plants glabrous.

Notes: Occurs in far south-eastern Queensland. Ecological and phenological details as for the type variety. Similar in all details to the typical variety except for the absence of hairs. Recorded as growing side by side with typical variety.

Representative specimens: QUEENSLAND: Brigalow research station, 32 km NW of Theodore, *Johnson 2670* (BRI); Mount Moon, 5 km SW of Mt Alford township, *P.I.Forster PIF6621, A.R.Bean & L.H.Bird* (BRI, MEL). NEW SOUTH WALES: Three Tops, Mt Warning National Park, July 1955, *A.Benwell s.n.* (NSW).

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<i>Gynura</i>	(107)
<i>Petasites</i>	(58)
<i>Roldana</i>	(59)
<i>Senecio</i>	(63)
<i>Senecio</i> – Disciform group	(63)
<i>Senecio</i> – Exotic species (except for <i>S. madagascariensis</i>)	(79)
<i>Senecio</i> – Glossanthus group	(76)
<i>Senecio</i> – Lautusoid group	(77)
<i>Senecio</i> – Macranthus group	(70)
<i>Senecio</i> – Magnificus group	(69)
<i>Senecio</i> – Odoratus group	(66)
<i>Senecio</i> – Ramosissimus group	(67)

The taxonomic status of *Lachnagrostis scabra*, *L. aequata* and other related grasses in Australia (Poaceae).

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Abstract

Early descriptions and treatments of *Lachnagrostis scabra* (Beauv.) Nees ex. Steud. and *L. aequata* (Nees) S.W.L. Jacobs are examined and compared to current determinations of herbaria collections. The results of this study show a confusing array of nomenclature and inconsistency in descriptions given of these taxa. Additional assessment of a range of morphological characters on more than 100 specimens find coastal *L. scabra* and *L. aequata* to be inseparable, but taxonomically distinct from collections previously determined as *L. scabra* from inland Tasmania. The name *L. scabra* takes precedence for the coastal entity while the inland material is published as a new taxon, *L. morrisii* A.J. Brown and shown to be distinct from *L. collicola* (D. Morris) S.W.L. Jacobs. Further related and new taxa, *L. scabra* subsp. *curviseta* A.J. Brown from Victoria and *L. nesomytica* A.J. Brown subsp. *nesomytica*, *L. nesomytica* subsp. *pseudofiliformis* A.J. Brown and *L. nesomytica* subsp. *paralia* A.J. Brown from Western Australia are also described.

Introduction

There has long been uncertainty about the taxonomic relationship between *Lachnagrostis scabra* (syn. *Agrostis rudis*) and *L. aequata* (*A. aequata*). Early treatments had very few specimens on which to form judgements but with many collections being made over the last 50 years or so, the opportunity to more rigorously assess this situation is now possible. The current paper reports on a re-examination of the earliest published descriptions and on some detailed morphological assessment of the bulk of extant collections. This paper is part of an ongoing series dealing with a reassessment of the genus for Australia. Note that unless indicated as n.v. all cited collections have been viewed by the author.

In her revision of Australian species of *Agrostis*, Vickery (1941) separated *A. aequata* Nees from *A. rudis* Roem. & Schult., based on the degree of seabridity of the sides of the glumes. She differentiated the former from the latter “in the smooth sides of the glumes, which are less distinctly acute, equal or subequal both in length and breadth, not exceeding 2 mm in length”. However, she also “retained both species until further material and field studies enable a conclusion to be reached”. In her paper, she only cites three collections of each taxon, including the types; all but one, originating from Tasmania. The exception was an *A. aequata* collection from Nelson in Victoria. All the collections dated from 1792 to 1894 and had coastal locations (where provided).

TAXONOMIC TREATMENT IN STATE FLORAS POST VICKERY (1941)

Black (1943) tentatively recorded *A. aequata* for South Australia on the basis of the Nelson collection. Jessop and Toelken (1986) added *A. rudis* to the South Australian

flora, based on a few specimens from the South-east region. They also noted that *A. aequata* had been collected twice from the extreme south of the South-east.

In Victoria, Willis (1970) recorded *A. rudis* from a number of localities in southern Victoria; Main Ck near Arthurs Seat, Lake Corangamite, Gorae West near Portland and the Lower Glenelg R. from Moleside Ck downstream to Nelson and noted that collections from Lake Corangamite and Nelson had been determined as *A. aequata* by Vickery. Vickery (1941) had not previously cited the Lake Corangamite collection, despite it being one of Mueller's from 1875. Willis considered *A. aequata* to be "a slight variant" of *A. rudis*; its differing characters being "features merely of degree". Walsh and Entwisle (1994) agreed with Willis, regarding *A. aequata* as "being easily accommodated within the range of variation exhibited by *A. rudis*".

Jacobs and Pickard (1981) recorded *A. aequata* for the Southern Tablelands of NSW, based on a single collection from 1949.

Curtis and Morris (1994) recognised both *A. rudis* and *A. aequata* for Tasmania but noted the former as a plant of inland areas ("damp areas on margins of forest from 200 to 1200 m altitude") and limited the latter to coastal habitats. They reported that *A. aequata* "has generally smaller spikelets, glumes usually smooth and panicles in which the majority of spikelets have unawned lemmas."

Jacobs (2001a) placed *A. rudis* and *A. aequata* in *Lachnagrostis* as *L. rudis* (Roem. & Schult.) Trin. and *L. aequata* (Nees) S.W.L. Jacobs, respectively. Jacobs (2002) later corrected *L. rudis* to *L. scabra* (Beauv.) Nees ex Steudel. Recently, Barker *et al.* (2005), in their census of vascular plants of South Australia, accepted *Lachnagrostis* as a valid genus and regarded *L. aequata* as a synonym of *L. scabra*.

EARLY DESCRIPTION AND NOMENCLATURE REVIEW

The type for *Agrostis scabra* R.Br. non Willd., presumably collected by Robert Brown, is without location, collection number or date, although a notation on the reverse side of the collection sheet states "Van Diemens Land – Adventure Bay". Adventure Bay is located on the east side of Bruny Island in SE Tasmania. Adventure Bay was also the location cited by Vickery (1941) for a collection "in swamps" of *A. rudis* by Nelson in February 1792 (n.v.). However, as David Nelson died of a inflammatory fever in Timor on 20.7.1789, after enduring 41 days at sea in a small open boat with Captain William Bligh and 17 other men, following the Mutiny on the *Bounty* (Orchard 1999), either the date or the collector or both must be incorrect. Prior to the mutiny, Nelson had made botanical collections during the *Bounty's* anchorage at Adventure Bay (Orchard 1999) from 20th August to 4th September 1788, but this late winter-early spring period is not conducive for the collection of mature *Lachnagrostis*. Bligh did return to Adventure Bay on the *Providence* from 9th – 24th February 1792 but with James Wiles and Christopher Smith as botanists (Orchard 1999). Further collections were made at that time, the bulk of which were eventually lodged at BM with duplicates at DPU, FI, G, HO and K and it seems more likely that the 'Nelson' collection derives from this material. Unfortunately, the Adventure Bay collection cannot be located and does not appear to have been viewed since Vickery did so in 1938. However, the handwriting on the type collection for *Agrostis parviflora* R.Br. from Adventure Bay "in black vegetable soil" and also labelled as Nelson, February 1792 in fact has been recently identified as that of Wiles (pers.com. R. Vickery). Nelson's name has been added to the sheet later by an unknown hand, perhaps in the belief that he was still Bligh's botanist in 1792. It is assumed that the *A. rudis* from Adventure Bay was treated likewise.

Robert Brown's trip to Australia of 1802-05 began as botanist for Captain Matthew Flinders on the *Investigator*. During the circumnavigation of Australia, Brown did make plant collections on King Island in Bass Strait (Moore 2000) and in Port Phillip Bay (Willis 1966) but only very late in the season (from April 23rd to May 3rd 1802). There is no mention of any grass collections in his diary notes of this period (Vallance *et al.* 2001). After the *Investigator* was condemned as unseaworthy, Brown returned to Tasmania on the *Lady Nelson*, leaving his collecting trips in the vicinity of Port Jackson on 28th November 1803. Originally planning to sail to Port Phillip, the *Lady Nelson* reached the Kent Island group in Bass Strait on 11th December where plant (mainly algae) collections were made (Moore 2000, Vallance *et al.* 2001). January 1st to 18th was spent at Port Dalrymple and along the Tamar River to the South Esk Gorge, near to the present site of Launceston. It is in this period that Brown records *Agrostis* along with other grasses on Green Island (opposite Outer Cove – now York Cove) on 3rd January 1804 and “immediately above the western arm” (a little further south of Green Island) on 5th January. Nine days were spent in Port Phillip Bay, Victoria from 21st to 30th January, assisting in packing up the ill-fated, Lt Col David Collins led settlement at Sullivans Bay (present day Sorrento) but Brown kept no diary of this period (Vallance *et al.* 2001). He then sailed south to Risdon Cove and Sullivans Cove, near present day Hobart, Tasmania with the settlers from Port Phillip Bay. From 9th February to 9th August 1803, after which he finally left Tasmania, Brown spent his time in the SE, largely exploring the Derwent River, Huon River and Mt. Wellington region. He made one late autumn-winter sea voyage towards the SW, including anchorage at Adventure Bay on 12th June (Vallance 2001). This appears to be the only occasion when Brown visited this site.

In Brown (1810), the description of his *A. scabra* collection is annotated with “J.D.”, the ‘J’ referring to “vicinity of Port Jackson (including Hunter’s River, Coal River)” and the ‘D’ to “Van Diemens Land” respectively. Bentham (1878) only refers to Brown’s collection as deriving from “Port Jackson”, while Vickery (1941) indicates “without locality”. Given the lack of any other collections from coastal NSW, the Port Jackson location is highly unlikely. The reference to Adventure Bay on the reverse side of the sheet also appears erroneous; given the maturity of the collection but the winter landing on Bruny Island. The notation may refer to the earlier ‘Nelson’ (actually Wiles) location instead or in fact, the specimen may be a duplicate taken from that collection. If Brown did collect his own specimen, the most likely location would be at Port Dalrymple during early January 1804 or possibly at Port Phillip Bay in late January 1804. Although an undated collection of *Agrostis aemula* (syn. *Lachnagrostis aemula*) was made at Port Dalrymple by Col Patterson during the following summer and passed on to Brown in early 1805 (Vickery 1941, Vallance *et al.* 2001), *L. scabra* was also collected from “Tamar” in March 1887 by Oakden. The island, shoreline and creek mouth habitat where Brown observed his *Agrostis* would be conducive to *L. scabra* growth whereas the forested hillsides around Port Dalrymple would be more likely habitat for *L. aemula*.

Brown’s (1810) description of his *A. scabra*, though brief, included keeled glumes with scabrid sides and a glabrous lemma with a denticulate apex and a spikelet-contained, dorsal awn. Roemer and Schultes (1817) and Steudel (1855) adopted Brown’s description without change. Meanwhile, Nees (1843), when describing *A. aequata*, based on an 1838 collection by Gunn (1005) from Van Diemen’s Land, describes the lemma as papery, smooth and obtuse and the glumes as equal with scabrid keels. There is no mention of the presence or otherwise of an awn.

When the two taxa were illustrated by Fitch and described by Hooker (1859) for Tasmania, the representations of his “*A. scabra* Br.” are clearly not the same as Brown’s

collection but appear to be a species or variant of *Deyeuxia*. The illustration (Plate CLXb) is rather similar to Fitch's rendering of *A. contracta* F. Muell. ex Hook.f. (syn. *D. contracta* (F. Muell. ex Hook.f.) Vickery), except that the lemma has a short, near apex awn and the palea is shorter, while Hooker's text includes *D. frigida* Mueller mss. (syn. *D. frigida* F. Muell. ex Benth.) as a synonym of *A. scabra* and suggested that the taxon may have been a variant of *A. montana* R.Br. non Krok (syn. *D. monticola* (Roem. & Schult.) Vickery). Hooker describes the taxon's spikelets as being "rough, often purple, $\frac{1}{6}$ inch long". At over 4 mm, these spikelets are somewhat larger than the 2.5 mm glumes, described by Vickery (1941) for *A. rudis*. Hooker also describes the lower palea (i.e. lemma) of *A. scabra* as "very rough, hard, sharp, nerves indistinct, awnless, or with a short, hardly exerted awn inserted at about the middle of the back". Apart from the inconsistent insertion of the awn, Fitch's illustration of the floret depicts Hooker's description well.

Hooker describes the habitat of *A. scabra* as being subalpine; from the foot of Mount Wellington, Arthurs Lakes etc.; citing collections from Gunn (1461, 1462), Areher and Oldfield (without numbers). In her treatment of *Deyeuxia*, Vickery (1940) recognised that Fitch's illustration and Hooker's description of *A. scabra* R.Br. were incorrect and assigns them to *D. scaberula* Vickery, although Gunn's "Arthurs Lakes" sample and Oldfield's unnumbered collection suggests that Hooker also included *D. accedens* Vickery in his *A. scabra*. Vickery (1940) placed the Tasmanian specimens of *D. frigida* cited by Bentham (1878) (Oldfield; New Norfolk, Gunn) in *D. accedens*. Despite her conclusions about Fitch and Hooker's rendering of *A. scabra*, Vickery (1941), when revising *Agrostis* still assigned Hooker's description to *A. rudis*. This was undoubtedly an oversight on her behalf.

Hooker's (1859) description of *A. aequata* spikelets expands on Nees (1843) account by stating that the glumes are "ovate, acute, hardly longer than the flower, very scabrid, especially along the keel" and that the paleas are "rather coriaceous, with obscure nerves, awnless; lower (i.e. lemma) truncate; upper (i.e. palea in the modern sense) nearly as long, with two small teeth at the tip, and sometimes a small tuft of hairs at the base" ("basi extus pedicello gracili" i.e. rachilla extension). Fitch's illustration also shows the glumes and lemma apex with ciliate margins. The collection by Gunn (1005) is cited by Hooker (1859) and is likely an isotype (Gunn, No. 1005/1837, 18.1.1838, H2003/00180 K) as Hooker's Plate No. CLIXb and pencil sketches of Fitch's illustration appear on one of the two sheets on which the type is mounted. Also attached to this type is a comment by Vickery, made on 9.7.1938 that it "matches type of *Agrostis aequata* Nees at Cambridge".

Bentham (1878) cited a few collections of these grasses from Tasmania but created a very confused scenario by his treatment of them. Gunn's collection (1005) was transferred to *Deyeuxia* as *D. aequata* Benth. (syn. *A. aequata* Nees), while he placed Brown's *A. scabra* and a collection from Adventure Bay (probably the erroneous 'Nelson'), in *D. scabra* Benth. However, also included in *D. scabra* were *D. contracta* and *D. decipiens* (R.Br.) Vickery (syn. *A. decipiens* R.Br.). Vickery (1940) regarded Bentham's description of *D. scabra* as also including her *D. scaberula*.

Bentham (1878) also designated the North American species, *A. scabra* Willd., for specimens from Tasmania, Victoria and NSW (regarding *A. parviflora* R.Br. as part of the species) and therefore, as a consequence, his appears to be the first Australian treatment to recognise *A. scabra* R.Br. non Willd. (i.e. as *Deyeuxia scabra* Benth.) as a separate taxon. The North American entity has, in the past, been regarded as a synonym for *A. hiemalis* (Walt.) Britton, Sterns and Poggenb. but has most recently been regarded as a separate taxon (Soreng and Peterson 2003). Although Vickery (1941)

“with some hesitation” placed a range of Australian specimens, including at least some of Bentham’s citations (excluding *A. parviflora*), in *A. hiemalis*, Jacobs (2001b) has subsequently replaced it with two new endemic species; *A. propinqua* S.W.L. Jacobs and *A. bettyae* S.W.L. Jacobs..

In Tasmania, Rodway (1903) followed Bentham’s (1878) treatment for *Deyeuxia* and *Agrostis* but included Circular Head (probably in reference to Gunn’s collection) and Trial Harbour (collection by Rodway, December 1894) as locations for *D. aequata*. His illustration of *D. scabra* Benth. is likely to be of *D. scaberula* while that for *A. scabra* Willd. appears to be of *A. parviflora*.

For his Victorian plant key, Mueller (1888) combined all *Deyeuxia* and *Agrostis* under *Agrostis*; listing *A. scabra* (probably as a synonym for *D. scabra* Benth.) and *A. rudis* (presumably for *A. scabra* R.Br. non Willd.). The latter would appear to have been made on the basis of the collection he made from Lake Corangamite in 1875. Tate (1890) recorded *A. scabra* Willd. for the Mount Gambier district of South Australia; probably on the basis of a collection of *A. scabra* R.Br. non Willd. he made in 1882 from Nelson, in Victoria, near the South Australian border (Tate Herbarium, 15.11.1882) and without taking account of Bentham’s (1878) separation of the North American taxon from the Australian entity or the presence of paleas in the florets of his specimen. Black (1922) recognised but renamed Tate’s collection, *Calamagrostis aequata* (Nees) J.M. Black for South Australia but Ewart² (1930) seems to have overlooked these taxa altogether for Victoria. His *Calamagrostis rudis* Steud. is cited as “a mountain grass” and probably refers to a *Deyeuxia* species (possibly *D. contracta*) while his *A. scabra* refers to the North American taxon.

Materials and Methods

MORPHOLOGICAL DESCRIPTION

At least 95% (134 specimens) of all current collections, determined as *L. scabra* and *L. aequata* at HO, MEL, AD and NSW were examined and measurements taken of leaf width, pedicel length (shortest and longest), glumes (lower and upper), glume setae, lemma, lemma setae, awn, palea, anther and rachilla extension length (including hairs) and the height of awn (if present) attachment on the lemma back. Ratings of the degree of scabridity of the keels (1-3) and sides (0-2) of the glumes and edges of the glume margins (0-2) and lemma apex nerves (0-2) were made. Measurements of spikelet and floret characters were made on one ‘typical’ mature example for each specimen. Panicle exsertion from the leaf sheath was noted and, if observed, peduncle length, panicle height and width and the distance between the two lower-most branch whorls (whorl separation) were measured.

In addition to types for *L. scabra* and *L. aequata* lodged at BM and K respectively, the 134 examined specimens (including the occasional duplicate) were as follows; Tasmania: 29 specimens of *L. aequata* from 23 locations, 23 specimens of inland *L. scabra* from 20 locations, 8 specimens from 3 sheets of *L. collicola* from 3 locations; Bass Strait Islands: 14 specimens of *L. aequata* from 8 locations; Victoria: 26 specimens of *L. scabra* from 21 locations; South Australia: 12 specimens of *L. scabra* from 10 locations; Western Australia: 21 specimens of an indeterminate taxon from 14 locations on Rottnest and Garden Islands. Among the Tasmanian collections, one determined as *L. aequata* (Archer undated and without location) was actually akin to

inland *L. scabra* while the reverse was true of another collection (Buchanan 8.1.1987 Wallaby Bay, Port Davey).

In addition to the collections as outlined above, two specimens from NSW, determined as *L. scabra* (originally determined as *A. aequata*) were also examined. One collected from Eden was found to be *Deyeuxia parviseta* var. *boormanii*. The other NSW collection, from Cathcart in 1949, was a very mature specimen with few intact spikelets and consequently difficult to determine with certainty. It appeared to conform to *L. scabra* in most discernible characters and could not be likened to any other taxonomic candidate, despite its somewhat disjunct location from the known distribution range of the species. Further fresh collections from the field are required before confirmation can be assured.

During examination of specimens determined as *L. scabra* at HO (hereafter referred to as 'inland *L. scabra*'), some similarities with the Tasmanian montane species, *L. collicola* (D. Morris) S.W.L. Jacobs were observed. Subsequently, morphological characters for *L. collicola*, were compared to inland *L. scabra* to test their relationship.

In the course of this study, a collection at MEL of five sheets by Walcott in 1881 from Rottnest Island, Western Australia of an indeterminate taxon of *Lachnagrostis* were examined. Labelled by Mueller as *Agrostis* sp. it has obvious affinities with the *L. scabra*/*L. aequata* material. Subsequently, more recent indeterminate PERTH material from Rottnest Island (one specimen) and Garden Island (three specimens) were examined, measured, and compared to the first. An additional seven collections were made by the author on Rottnest Island in December 2004 and, although very mature, were still intact enough to examine vegetative, inflorescence and spikelet characteristics. A further nine collections were made in November 2005, at a time when plants were still green and inflorescences were emerging and becoming divergent.

STATISTICAL TREATMENT

Except for *L. collicola*, which was treated as a separate entity, examined specimens were grouped according to geographical source; i) Tasmania Mainland - Inland, ii) Tasmania Mainland - Coastal, iii) Tasmania - Bass Strait Islands, iv) East Coast Victoria and New South Wales, v) West Coast Victoria and South Australia and vi) Western Australia. A range of statistical analyses were undertaken using Genstat 8.1 (Release PL16, Lawes Agricultural Trust, Rothamstead Experimental Station). A correlation matrix (CORRELATE) for the character measurements was produced. In addition, a Symmetric Matrix (SYMMETRICMATRIX) of associations for the characters was established by forming a Similarity Matrix (FSIMILARITY) (using euclidean variate type for continuous variables and cityblock variate type for discontinuous variables). This matrix was used in both a Principle Coordinates Analysis (PCO) and a Hierarchical Cluster Analysis (HCLUSTER) (using Furthest Neighbour criterion) to assess natural groupings of the specimens. All of the measured characters were used in the multivariate analysis except for inflorescence height, width and distance between lower branch whorls (excluded because of unmeasurable characters in many specimens due to non-exserted panicles). Analysis of Variance (ANOVA) (LSD at 5%) for each measured character, was also performed using i) geographical source and ii) 75% threshold cluster groups, as treatments. For awn and inflorescence measurements, ANOVA was restricted to specimens with awns or exerted panicles respectively.

Table 1: Means in morphological characters (all lengths in mm) and percent of specimens with exerted inflorescences, hairy lemmas and awned lemmas for various taxa (designated by both old and new specific names) and geographical groupings (values followed by the same letter are not significantly different at 95% confidence limits).

Character	Tas. Mainland	Tas. Mainland	Tas. Mainland	Bass Islands	East Vic and NSW	West Vic and SA	West Aust Islands
<i>locale</i>	inland	inland	coastal	coastal	coastal	coastal	island
<i>old name</i>	<i>collicola</i>	<i>scabra</i>	<i>aequata</i>	<i>aequata</i>	<i>scabra</i>	<i>scabra</i>	<i>indet.</i>
<i>new name</i>	<i>collicola</i>	<i>morrisii</i>	<i>scabra</i>	<i>scabra</i>	<i>scabra</i>	<i>scabra</i>	<i>nesomytica</i>
Leaf width	1.6 <i>ab</i>	2.4 <i>cd</i>	1.9 <i>bc</i>	1.5 <i>ab</i>	2.1 <i>bed</i>	2.7 <i>d</i>	1.2 <i>a</i>
Inflor. exertion ^a	38	61	66	86	60	75	81
Inflor. height ¹	77 <i>a</i>	109 <i>ab</i>	142 <i>ab</i>	135 <i>ab</i>	132 <i>ab</i>	174 <i>b</i>	109 <i>ab</i>
Inflor. width ¹	53 <i>a</i>	104 <i>ab</i>	89 <i>ab</i>	104 <i>ab</i>	105 <i>ab</i>	111 <i>b</i>	112 <i>b</i>
Whorl separation ¹	14 <i>a</i>	24 <i>ab</i>	38 <i>abc</i>	26 <i>ab</i>	39 <i>abc</i>	44 <i>bc</i>	64 <i>bc</i>
Shortest pedicel	13.3 <i>d</i>	11.3 <i>c</i>	2.1 <i>a</i>	1.6 <i>a</i>	1.9 <i>a</i>	1.9 <i>a</i>	5.9 <i>b</i>
Longest pedicel	28.5 <i>c</i>	27.4 <i>c</i>	7.1 <i>a</i>	7.6 <i>a</i>	7.3 <i>a</i>	6.2 <i>a</i>	17.6 <i>b</i>
Lower glume	3.81 <i>e</i>	2.56 <i>d</i>	2.22 <i>c</i>	1.49 <i>a</i>	1.90 <i>b</i>	1.95 <i>bc</i>	2.54 <i>d</i>
Glume setae	0.18 <i>c</i>	0.08 <i>b</i>	0.07 <i>b</i>	0.00 <i>a</i>	0.02 <i>a</i>	0.03 <i>ab</i>	0.01 <i>a</i>
Upper glume	3.76 <i>d</i>	2.54 <i>c</i>	2.20 <i>bc</i>	1.54 <i>a</i>	1.91 <i>b</i>	1.90 <i>b</i>	2.33 <i>c</i>
Keel scabrid ^b	2.0 <i>b</i>	2.0 <i>b</i>	2.6 <i>c</i>	2.5 <i>c</i>	1.9 <i>b</i>	2.0 <i>b</i>	1.3 <i>a</i>
Lateral scabrid ^b	1.8 <i>c</i>	0.7 <i>b</i>	1.1 <i>b</i>	1.4 <i>c</i>	1.5 <i>c</i>	1.3 <i>bc</i>	0.1 <i>a</i>
Glume margins ^b	0.6 <i>b</i>	0.1 <i>a</i>	1.9 <i>d</i>	2.0 <i>d</i>	1.9 <i>d</i>	1.9 <i>d</i>	1.0 <i>c</i>
Lemma length	3.11 <i>d</i>	2.11 <i>c</i>	1.69 <i>b</i>	1.30 <i>a</i>	1.68 <i>b</i>	1.61 <i>b</i>	1.62 <i>b</i>
Lemma setae	0.33 <i>c</i>	0.06 <i>ab</i>	0.09 <i>b</i>	0.01 <i>a</i>	0.03 <i>ab</i>	0.03 <i>ab</i>	0.01 <i>a</i>
Lemma nerve ^b	0.0 <i>a</i>	0.0 <i>a</i>	1.8 <i>c</i>	1.5 <i>bc</i>	1.6 <i>c</i>	1.1 <i>b</i>	0.0 <i>a</i>
Hairy lemmas ^a	0	0	0	0	0	25	38
Lemma hairs ^{b2}	-	-	-	-	-	0.1 <i>a</i>	1.0 <i>b</i>
Callus hairs	0.49 <i>c</i>	0.33 <i>b</i>	0.25 <i>ab</i>	0.11 <i>a</i>	0.30 <i>b</i>	0.33 <i>b</i>	0.22 <i>ab</i>
Awn presence ^a	100	100	38	29	33	54	100
Awn attach ³	89.6 <i>d</i>	94.1 <i>d</i>	71.1 <i>ab</i>	75.6 <i>bc</i>	79.5 <i>bc</i>	76.5 <i>bc</i>	63.5 <i>a</i>
Awn length ³	2.50 <i>b</i>	0.61 <i>a</i>	0.51 <i>a</i>	0.36 <i>a</i>	0.48 <i>a</i>	0.38 <i>a</i>	1.74 <i>b</i>
Palea length	2.51 <i>d</i>	1.83 <i>c</i>	1.61 <i>b</i>	1.26 <i>a</i>	1.55 <i>b</i>	1.52 <i>b</i>	1.49 <i>b</i>
Rachilla extens.	2.14 <i>d</i>	0.97 <i>bc</i>	0.79 <i>b</i>	0.46 <i>a</i>	1.01 <i>bc</i>	1.10 <i>c</i>	0.96 <i>bc</i>
Anther length	0.70 <i>d</i>	0.50 <i>bc</i>	0.53 <i>c</i>	0.41 <i>a</i>	0.41 <i>a</i>	0.45 <i>ab</i>	0.52 <i>bc</i>

^a Percent of specimens with character, ^b discrete variable recorded as a rating, ¹ Restricted to specimens with exerted inflorescences, ² Restricted to specimens with hairs on lemmas, ³ Restricted to specimens with lemma awns

Results

MORPHOLOGICAL ASSESSMENT

The correlation matrix (not provided) showed high ($r^2 = 0.85-0.98$) positive relationships between spikelet (glumes) and floret (lemma and palea) lengths as would be expected. In relation to glume and lemma lengths, anther length was moderately correlated (0.62-0.70), rachilla extension length was less correlated ($r^2 = 0.55-0.64$) and awn length was poorly correlated (0.32-0.59). Over all taxa, awn attachment height was poorly correlated ($r^2 = -0.39$) to awn length although, within the WA island populations, correlations were high and negative ($r^2 = -0.86$). High negative correlations ($r^2 = -0.77-0.82$) were also found between glume margin cilia and the length of the shortest and longest pedicels, and pedicel lengths were moderately and positively correlated ($r^2 = 0.64-0.67$) to glume length. In other words, spikelets with longer pedicels had less evident cilia and tended to be larger. Glume margin cilia was positively correlated ($r^2 = 0.69$) to lemma apex nerve cilia but glume (lower and upper) scabridity (keels and laterals) were poorly correlated (0.27-0.53) to these characters. Other correlations (e.g. involving leaf width, callus hair length, inflorescence size) were mostly low ($r^2 < 0.50$). Figures 1 and 2 show the results of PCO and hierarchical cluster analyses respectively.

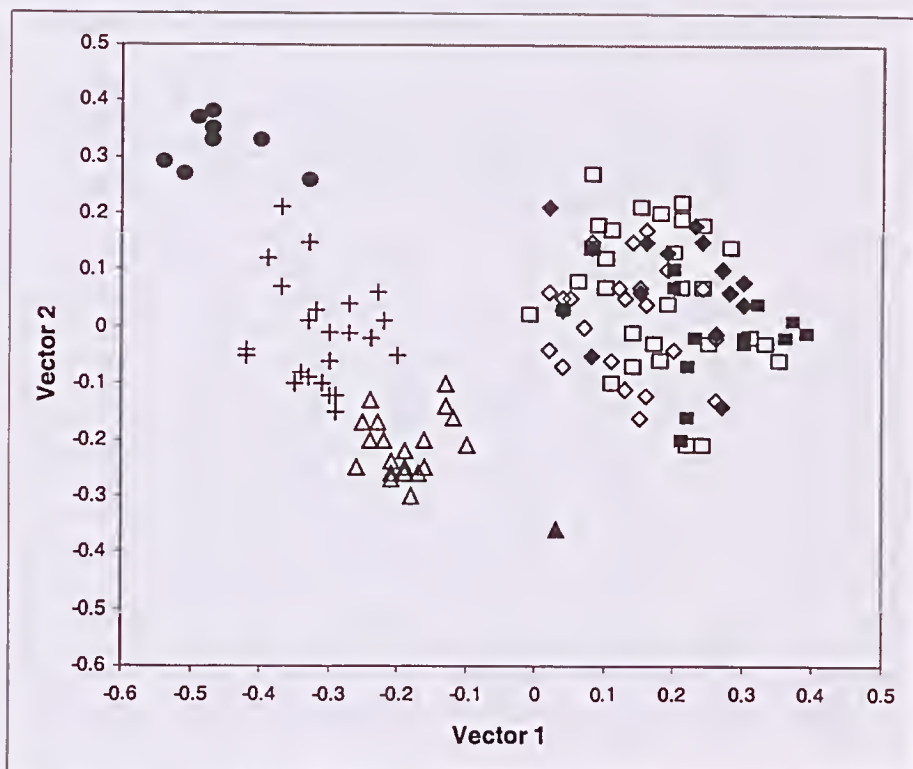


Figure 1. Vectors 1 and 2 of principle coordinate analysis of all examined specimens; *L. collicola* - Tasmania (●), inland *L. scabra* - Tasmania (+), *L. sp.* - Western Australian islands (Δ), *L. aequata* - Tasmania (□), *L. aequata* - Bass Islands (■), *L. scabra* - Western Victoria/South Australia (◇), *L. scabra* - Eastern Victoria (◆), indeterminate *L. sp.* - Cathcart, NSW (▲).

Lachnagrostis collicola, inland *L. scabra* and the WA islands plants are clearly separated in the PCO analysis from each other and strongly separated from a widely scattered and intermingled grouping containing coastal *L. scabra* and *L. aequata* (Figure 1). Vectors 1 and 2 of the PCO accounted for 51.3% of the total variation with vectors 3, 4 and 5 providing an extra 7.5%, 7.2% and 6.1% respectively. Table 1 shows the means in results for the characters measured for the various taxa and geographical groupings.

Lachnagrostis collicola is significantly different from the other taxa in having larger spikelets (lower and upper glume and glume setae length) and florets (lemma, lemma setae, awn, palea, callus hairs, rachilla extension and anther lengths). Ranges in both glumes, lemma, palea and rachilla extension length do not overlap with the ranges for these measurements on the other taxa. *Lachnagrostis collicola* is similar to inland *L. scabra* in always being awned and having a similar and high awn attachment, having

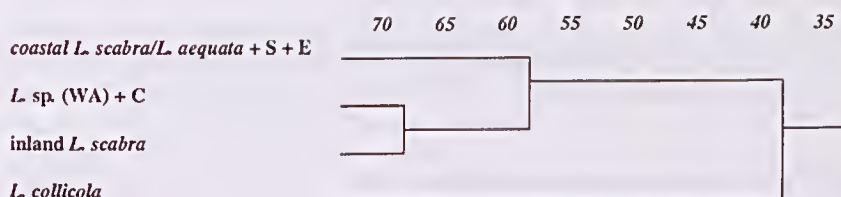


Figure 2. Dendrogram of hierarchical cluster analysis (furtherest-neighbour criteria) for all specimens (C = Catheart specimen, S = Sherbrooke River specimen, E = Eight Mile Creek specimen); at 75% separation.

the same range in pedicel length and in lacking ciliate lemma nerves. However, in addition to its larger spikelets and florets, it differs from the latter, in almost always having narrower leaves and more seabrid sides to its glumes. The inland *L. scabra* from Tasmania is hereby recognised as a new taxon, separate to both *L. collicola* and coastal *L. scabra/L. aequata* and is described as *L. morrisii* A. J. Brown.

The material from Rottnest and Garden Islands is most similar to the montane *L. morrisii* but has, on average, smaller lemmas and paleas, longer awns that have lower lemma attachment, shorter callus hairs (often absent), less seabrid glumes but with more marginal cilia, shorter pedicels and narrower leaves with distinctly separate ranges for lemma length and awn attachment. From *L. scabra/L. aequata*, the specimens differ in having, on average, longer glumes (except for the Tasmanian group), awns and pedicels, but particularly in having less seabrid and/or ciliate glumes and lemma apices. These character differences, its habitat and its geographical isolation from the eastern Australian taxa have prompted the recognition of this entity as a new species; described as *L. nesomytica* A.J. Brown.

Although all the collections of *L. nesomytica* are superficially similar and were not clearly separated in the PCO (at least for the first two vectors) or hierarchical cluster analyses, some populations, as well as being geographically separated, are distinct enough to warrant recognition as separate subspecies. The populations on Rottnest Island are confined to the edges of saline lakes and swamps and obviously have high salt tolerance. Populations at Bickley Swamp, Serpentine and Government House Lakes (from the south-east part of the Island), differ from the remaining populations by having geniculate awns and moderately hairy lemmas. In these characters they resemble a stunted form of *L. filiformis* (Forst.) Trin. but have smaller spikelets and florets, longer anthers, shorter awns, longer pedicels and stiffer inflorescences with more divaricate branches. Typical *L. filiformis* has not been collected from the Island, although it occurs reasonably commonly on the adjacent mainland. The hairy lemma form of *L. nesomytica* is described here as subsp. *pseudofiliformis* A.J. Brown. The populations of *L. nesomytica* from the nearby Garden Island have been collected from coastal dunes in thickets of *Callistris preissii* and *Melaleuca lanceolata*; a highly calcareous but less saline environment (McArthur 1957) than that encountered by the other subspecies. Although having glabrous lemmas, as for typical *L. nesomytica*, they have longer, often curved to geniculate awns; though these are not as long as for subsp. *pseudofiliformis*. This entity is described as subsp. *paralia*.

The distributions of *L. aequata* from coastal Tasmania and the Bass Strait Islands and coastal *L. scabra* from the mainland are not separable and readily encompass the types for both taxa (Figure 1). They are therefore regarded as a single taxon; *L. scabra*

(Beauv.) Nees ex Steudel. Table 1 shows some significant differences in characters between geographical location for the taxon (e.g. the Bass Is collection has the smallest spikelets and florets and the Tasmanian collection has the largest anthers), but overall ranges (not provided) in these characters overlap. The degree of scabridity of the sides of the glumes, which was the main character used by Vickery (1941) to distinguish between *Agrostis rudis* and *A. aequata*, was found to be extremely variable and poorly correlated with any other measured character (the best correlation being only $r^2 = 0.32$ with the degree of glume margin ciliation). The presence of lemma awns is not linked to geographical location or correlated to spikelet/floret size. In some cases, both awned and unawned lemmas appear on the same specimen. Inequality in glume lengths bears little relationship to geographical location or to any other measured character.

Most specimens of *L. scabra* from the Furneaux Group of Bass Strait Islands, were small tussocks with divergent inflorescence branches and awnless or minutely awned lemmas. Apart from the general lack of awns, these plants have some resemblance to *L. nesomytica* subsp. *uesomytica*. However the latter have significantly longer pedicels and lack the cilia of lemma apices and the degree of glume scabridity. Although it is tempting to separate the Bass Strait Islands *L. scabra* from the mainland entity, there does not appear to be any clear difference in morphology, apart from tussock and inflorescence size. Plants of very similar tussock and inflorescence appearance but with hairy and long-awned lemmas are also found on these islands and are likely to represent a stunted form of *L. filiformis*. Another similar entity with hairy lemmas and very short, non-geniculate awns also occurs on Flinders Island, but its relationship to other Island forms is still under investigation by the author.

Examination of a previously indeterminate specimen at AD, collected by Eardley in 1942 from Eight Mile Creek, near Port MacDonnell, SA, was found to conform to *L. scabra* in all respects except that some of its lemmas had scattered short hairs near the margins of the lateral surfaces. Despite Eardley's comment that the grass 'comes in everywhere there', recent field searches for this population by the author has failed to find it. Closer examination of other specimens of *L. scabra* found at least five others with lemma hairs, all from South-east SA to South-west Victoria. However, these appeared to have only the occasional short hair on the occasional lemma and are therefore easily overlooked. Other specimens could well have the same condition. The sporadic and seemingly haphazard occurrence of this trait provides little support for creating a taxonomic distinction within *L. scabra*.

Another specimen, at MEL, labelled as *L. aff. scabra*, from Sherbrooke River, Port Campbell National Park (*Beaunglehole and Finke* 21182, 6.ix.1966), also has an occasional hair on lemma margins but is distinguished from other *L. scabra* collections, in having longer (up to 1.4 mm) and often curved to somewhat flexuose or geniculate, very fine awns. This character appears distinctive enough to designate the specimen as a new taxon; *L. scabra* subsp. *curviseta*. The specimen from Wallaby Bay, Port Davey (*Buchanan* 9339, 8.i.1987), that had previously been determined at HO as inland *L. scabra*, has some awns from 0.9-1.1 mm long but these are straight and not curved.

Table 2: Means in morphological characters (all lengths in mm) for cluster grouping of *Lachnagrostis scabra* sensu strict. (i.e. coastal *L. scabra* and *L. aequata*) and percent of specimens within those groupings, according to geographical location.

Character	Group 1 <i>n</i> = 44	Group 2 <i>n</i> = 6	Group 3 <i>n</i> = 25	Group 4 <i>n</i> = 7
Leaf width	2.0 <i>b</i>	2.3 <i>b</i>	2.7 <i>b</i>	0.9 <i>a</i>
Inflorescence exertion ^a	70	94	57	62
Inflorescence height ¹	148 <i>b</i>	152 <i>b</i>	175 <i>b</i>	50 <i>a</i>
Inflorescence width ¹	108 <i>b</i>	107 <i>b</i>	103 <i>b</i>	45 <i>a</i>
Whorl separation ¹	34 <i>b</i>	54 <i>c</i>	44 <i>bc</i>	15 <i>a</i>
Shortest pedicel	1.7 <i>a</i>	1.7 <i>a</i>	1.9 <i>a</i>	3.3 <i>b</i>
Longest pedicel	7.1 <i>a</i>	5.5 <i>a</i>	6.3 <i>a</i>	9.9 <i>b</i>
Lower glume	1.78 <i>a</i>	1.92 <i>a</i>	2.09 <i>a</i>	2.67 <i>b</i>
Glume setae	0.01 <i>a</i>	0.02 <i>a</i>	0.03 <i>a</i>	0.23 <i>b</i>
Upper glume	1.78 <i>a</i>	1.92 <i>a</i>	2.05 <i>a</i>	2.66 <i>b</i>
Glume keel scabrids ^b	2.3 <i>a</i>	2.2 <i>a</i>	2.3 <i>a</i>	2.4 <i>a</i>
Glume lateral scabrids ^b	1.4 <i>b</i>	0.5 <i>a</i>	1.3 <i>b</i>	1.1 <i>b</i>
Glume margins ^b	2.0 <i>b</i>	1.0 <i>a</i>	2.0 <i>b</i>	2.0 <i>b</i>
Lemma length	1.49 <i>a</i>	1.52 <i>ab</i>	1.72 <i>b</i>	1.96 <i>c</i>
Lemma setae	0.02 <i>a</i>	0.03 <i>a</i>	0.07 <i>ab</i>	0.13 <i>b</i>
Lemma nerve ^b	1.4 <i>a</i>	1.3 <i>a</i>	1.5 <i>ab</i>	2.0 <i>b</i>
Lemma hairs ^b	0.0 <i>a</i>	0.0 <i>a</i>	0.2 <i>a</i>	0.0 <i>a</i>
Callus hairs	0.18 <i>a</i>	0.27 <i>ab</i>	0.39 <i>b</i>	0.21 <i>a</i>
Awn presence ^a	11	33	100	14
Awn attachment ²	71.8 <i>a</i>	75.2 <i>a</i>	75.9 <i>a</i>	70.0 <i>a</i>
Awn length ²	0.23 <i>a</i>	0.55 <i>a</i>	0.50 <i>a</i>	0.40 <i>a</i>
Palea length	1.40 <i>a</i>	1.48 <i>a</i>	1.60 <i>a</i>	1.86 <i>b</i>
Rachilla extension	0.75 <i>a</i>	1.07 <i>b</i>	1.12 <i>b</i>	0.50 <i>a</i>
Anthier length	0.43 <i>a</i>	0.48 <i>a</i>	0.48 <i>a</i>	0.59 <i>b</i>
Tasmania - Mainland (<i>n</i> = 29) ^a	38	10	28	24
Tasmania - Bass Islands (<i>n</i> = 14) ^a	93	0	7	0
East Victoria/NSW (<i>n</i> = 15) ^a	60	7	33	0
West Victoria/SA (<i>n</i> = 24) ^a	46	8	46	0

^a Percent of specimens with character, ^b discrete variable recorded as a rating, ¹ Restricted to specimens with exerted inflorescences, ² Restricted to specimens with lemma awns

Because the overall collection of *L. scabra* (i.e. coastal *L. scabra* and *L. aequata*) showed a wide range in plant size, glume scabridity and other morphological features, more or less regardless of geographical location, further examination for possible taxonomic differentiation was made via hierarchical cluster analysis. When *L. scabra* was pooled without location differentiation and separately analysed from the other taxa, it formed two groups at the 60% threshold clustering and four groups at 70%. A dendrogram resulting from this analysis is shown in Figure 3. Floret (lemma and palea) size appears to be the major character separating the data at 60% clustering, but there is considerable overlap in the ranges for these measures. Members of Groups 1, 2 and 3 came from across the range of geographical locations, with the exception that almost all the Bass Strait Islands specimens fell into Group 1. Group 4 only had specimens from south-west, coastal Tasmania. Table 2 presents significant differences in means for morphological characters between these groups.

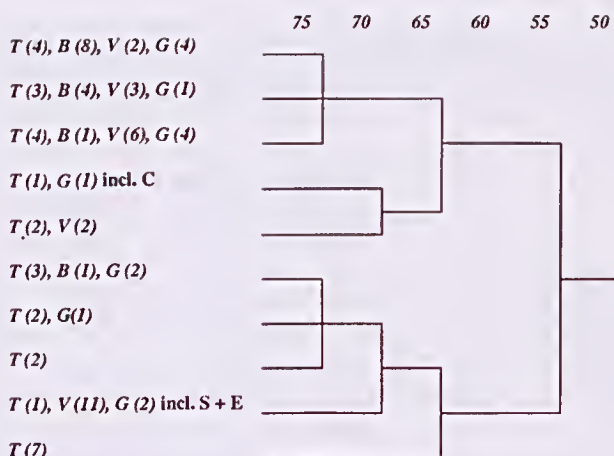


Figure 3. Dendrogram of hierarchical cluster analysis (further-neighbour criteria) for coastal *L. scabra/aequata* specimens (C = Cathcart specimen, S = Sherbrooke River specimen, E = Eight Mile Creek specimen) (numbers in parenthesis refer to number of specimens from geographical groupings in cluster at 80% separation; T = Tasmanian mainland, B = Bass Strait Islands, V = West Vic/SA, G = East Vic/NSW).

All but one of the specimens with lemma hairs were clustered together in Group 3 but in the original cluster analysis and in both PCO analyses they were dispersed throughout the data set. In terms of mean values, Group 4 significantly differed from the other groups in having the longest pedicels, spikelets (glumes, glume seta) and florets (lemmas, paleas and anthers) but the shortest rachilla extensions, the smallest inflorescences (height and width and whorl separation) and the narrowest leaves. However, in all these characters, their ranges overlap with the ranges of the other groups and cannot be used for diagnostic separation. Group 1 is only significantly different from Groups 2 and 3 in having shorter rachilla extensions. Group 2 is only significantly different from Groups 1 and 3 in having glumes with less seabrid laterals and ciliate margins. Again, ranges for these characters overlap between the groups. To give an example of range overlap; if all specimens with glumes 1.5 mm or less are considered (16 specimens; nine from Bass Islands, three from Tasmania and two each from East Vic/NSW and West Vic/SA), there are three awned with awn length ranging from 0.1–0.6 mm, shortest pedicels from 0.5–2 mm, longest pedicels from 4–13 mm, leaf width from < 1–2.5 mm and inflorescence height from 3–29 cm. At the other end of the scale; taking specimens with glumes 2.5 mm or greater (10 specimens; nine from Tasmania and one from Gippsland), there are six awned with awn length from 0.3–1.1 mm, shortest pedicels from 1–5 mm, longest pedicels from 4–21 mm, leaf width from < 1–4 mm and inflorescence height from 2–21 cm. In conclusion therefore, it does not appear feasible to segregate subspecific or varietal taxa from *L. scabra*, apart from subsp. *curviseta*.

The indeterminate specimen from Cathcart, NSW is separated from the main body of *L. scabra* in the PCO analysis (Figure 1). In the original (all specimens) hierarchical cluster analysis, the Cathcart sample appears with the Western Australian specimens (Figure 2) but then with Group 2 of the subsequent analysis of *L. scabra* only (Figure

3). Its advanced maturity meant that characters such as glume scabridity and lemma apex ciliation could not be adequately determined and its partially intact inflorescence does not provide a full description. It remains indeterminate until further collections in the locality can be made, if of course, it is extant.

Taxonomy

KEY TO TAXA TREATED IN THIS STUDY

The following key to the species of *Lachnagrostis* only deals with taxa of montane and coastal habitats and with small spikelets (4.0 mm or less). Other coastal or sometimes coastal taxa with larger spikelets are *L. billardierei*, *L. punicea* and *L. robusta* and descriptions of these can be found in Brown and Walsh (2000). Note that *L. scabra* has occasionally been found inland and *L. filiformis* is found from coastal to highland habitats. Mainly a lowland and ranges taxa, *L. aenuula* sometimes occurs in montane habitats as well, but normally has larger spikelets than those dealt with here. It is the author's intention to provide a full key once the current revision of the genus is completed.

1. Shortest spikelet pedicels less than 4 mm long, lemma awned or unawned 2
1. Shortest spikelet pedicels 4 mm long or more, lemma always with an awn (sometimes minute)..... 6
2. Awns present, geniculate and at least twice the length of the lemma *L. filiformis*
2. Awns absent or if present, then less than twice the length of the lemma..... 3
3. Lemma covered in hairs..... 4
3. Lemma glabrous or with a few scattered hairs towards the margins..... 5
4. Plants mostly 10 cm in height or less, young leaf blades closely folded, anthers c 1.0 mm long *L. meionectes*
4. Plants mostly 20-40 cm in height, young leaf blades flat, anthers 0.6-0.8 mm long..... *L. laciniatum*
5. Awn absent or less than 1.0 mm long, more or less straight and not or hardly exceeding glumes..... 1a. *L. scabra* subsp. *scabra*
5. Awn 1.0 mm long or more, mostly curved to geniculate and exceeding glumes by 0.5 mm 1b. *L. scabra* subsp. *curviseta*
6. Awn arising from near the lemma apex or excurrent to the central nerve of the lemma..... 7
6. Awn not excurrent to the central nerve of the lemma but attached between $\frac{1}{2}$ and $\frac{3}{4}$ of the lemma back..... 8
7. Glumes greater than 3.0 mm long (occasionally shorter if immature), awns generally greater than 1.5 mm long 4. *L. collicola*
7. Glumes 3.0 mm long or less, awns less than 1.5 mm long 2. *L. morrissi*
8. Awns mostly greater than 1.0 mm long, exceeding glumes, often curved to geniculate 9
8. Awns to 0.8 mm long, not exceeding glumes, straight..... 3a. *L. nesomytica* subsp. *nesomytica*

9. Lemmas glabrous, awns generally 2.5 mm long or less.....3c. *L. nesomytica* subsp. *paralia*
9. Lemmas covered with scattered hairs, awns generally greater than 2.5 mm long.....3b. *L. nesomytica* subsp. *pseudofiliformis*

TAXON DESCRIPTIONS

1. *Lachnagrostis scabra* (Beauv.) Nees ex. Steudel, *Nom. Botan.* Edn 2, 1:250 (1840); *Agrostis scabra* R.Br., *Prodr.* 172 (1810) non Willd. (1797); *Vilfa scabra* Beauv., *Agrost.* 16 (1812); *Agrostis rudis* Roem. & Schult., *Syst. Veg.* 2:360 (1817); *Lachnagrostis rudis* (Roem. & Schult.) Trinius, *Fund. Agrost.* 128 (1820); *Deyeuxia scabra* (Beauv.) Kunth, *Rev. Gram.* 1:77 (1829); *Calamagrostis rudis* (Roem. & Schult.) Steudel, *Syn. Pl. Gram.* 192 (1854). *Type*: Port Dalrymple, Tasmania (probable location), 1802-05, R. Brown (possible collector) (BM).

Agrostis aequata Nees, in Hook. *Lond. J. Bot.* 2:412 (1843), *Deyeuxia aequata* (Nees) Benth., *Fl. Austr.* 7:578 (1878); *Calamagrostis aequata* (Nees) J.M. Black, *Fl. South Australia*, Part 1:70 (1922); *Lachnagrostis aequata* (Nees) S.W.L. Jacobs, *Telopea* 9(3):445 (2001). *Type citation*: Tasmania, 18.1.1838, *Gunn 1005* (type: CGE n.v., probable isotype: K). [note: it is assumed on the basis of Vickery's comment on the isotype, that it is an adequate duplicate of the holotype].

Mid to light-green, loosely tufted or shortly rhizomatous, sometimes stoloniferous, glabrous, *annual or perennial*, of variable height from 10< cm (particularly in exposed coastal positions and on the Bass Strait Islands) to 200 cm (particularly in damp forests and on moist limestone rock faces); culms weakly ascending or scrambling to lax. *Leaf* blades rather lax, smooth, flat, to 15 cm long and from 0.2-4.0 mm wide; ligules obtuse, 1-3 mm long. *Inflorescence* generally a sparse, open panicle with spreading but rather lax and undulating branches (except in stunted plants), to 25 cm long or occasionally more, its base initially enclosed by the upper leaf sheath but often becoming exerted in mid-maturity; branches and pedicels green, or purplish where plants more exposed. *Spikelets* (1.3-)1.5-2.5(-3.0) mm long, pale to light green or sometimes purplish, on relatively short pedicels (shortest less than 4 mm long, longest almost always less than 15 mm long); glumes acute and keeled, subequal (sometimes the upper 0.1-0.2 mm longer), scabrous along the keel and often scaberulous or minutely papillose on the lateral surfaces (sometimes becoming densely scabrous towards the apex) but sometimes smooth, margins finely ciliate (at least in the upper half); lemma acute or obtuse, (1.1-)1.3-2.0(-2.2) mm long, minutely 4-toothed at the apex, generally with the upper nerves and teeth minutely and densely ciliate, body glabrous although very occasionally with a few scattered hairs near the margins on some florets in occasional populations, callus glabrous or with a few to some hairs 0.1-0.5 mm long; palea subequal to the lemma and often with a similarly ciliate and often rather obtuse apex; rachilla extension glabrous or plumose, (0.1-)0.4-1.5(-1.7) mm long (including hairs) or sometimes absent; anthers 0.3-0.6(-0.7) mm long. **Rough Blown-grass**

Notes: Also known as Even Blown-grass after 'aequata' due to its subequal glumes, lemma and palea, or as Ruddy Bent, presumably after 'rudis' though the latter means 'rough' or 'rude' and only purplish stunted specimens from exposed positions could be thought to approach 'reddish'.

1a. *Lachnagrostis scabra* subsp. *scabra*

Lemmas awnless or with a minute, fine and straight awn, 0.1-0.7(-1.1) mm long, arising from within the upper third of the lemma back and not or hardly exceeding the glumes (Fig 4a-h).

Distribution: Not common. Scattered along or within 15 km inland of the southern mainland coastline from Lake Tyers in Gippsland to Nelson in far-west Victoria and into south-east South Australia as far as Robe. Collections from further inland have been made in association with *Leptospermum lanigerum* near Lake Corangamite (Mueller 1875) and Poolaigelo at Salt Creek (K. Alcock 22.xii.1985) and Wannon Swamp (K. Alcock 1.i.1994) in Western Victoria. Also found on the Bass Strait Islands and scattered along the western and south-western coastline of Tasmania from Trial Harbour to South Cape Bay and Adventure Bay with some isolated occurrences on the north-western coast. An unverified determination on senesced material has also been made for Catheart (A.B. Costin 29, viii.1949), New South Wales (Fig 5).

Ecology: Growing in damp ground, including seepage slopes, stream banks and swamps. Also found in cracks on limestone rock ledges and cliff faces and in sand and rocks above high tide on the fringe of coastal scrub. The species appears to be intolerant of hot, dry conditions and its absence from the east coast of Tasmania may reflect this, where annual rainfall is only half that of the west coast and maximum temperatures are higher.

Historical note: The location for Mueller's collection (March 1875 MEL2124488) was only given as "swamps at Lake Corangamite between *Leptospermum lanigerum*".

If it is assumed that Mueller was in fact referring to the vicinity of the Lake itself (which has a shoreline of at least 150 km) and not just a district within Victoria, the most probable site is about 10 km to the east of the Lake, at the Cummel or Camel Springs, Warrion (originally called Ti Tree). Later, but before the advent of automobiles, these freshwater springs were in the heart of a Common that supplied drinking water for cattle and horses on their way to market or which roamed free, grazing road reserves and crown land (*pers com.* E.W. Brown). If this were the collection site, it is unlikely that *L. scabra* survived the rigours of stock grazing and trampling, once this activity commenced in force. Certainly, recent searches in the area by the author have failed to find any remnant of the species or even the original Tea Tree. Surprisingly, *L. scabra* has never been collected anywhere else in the Volcanic Lakes district of Western Victoria.

Selected Specimens: **TASMANIA:** Tamar, iii.1887, *Oakden* (Formby 56) (MEL); Trial Harbour, xii.1894, *Rodway* (HO); Ettrick River, King Island, 7.iii.1966, *Willis* (MEL); Pot Boil Lagoon, Flinders Island, 15.i.1977, *Whinray* 1522 (AD); Point Erie, Coxs Bight, 31.xii.1982, *Morris* 82104 (HO); Pennerowne Point, 26.i.1984, *Moscal* 5942 (HO, AD); 5 km south of Endeavour Bay, 30.i.1984, *Moscal* 6014 (HO); Wallaby Bay, Port Davey, 8.i.1987, *Buchanan* 9339 (HO); Welome River, north of Redpa, 17.iv.1996, *Johnson* (HO). **SOUTH AUSTRALIA:** Rendelsham, 4.iii.1944, *Cleland* (AD); Dry Creek, Glenelg River, 29.xii.1963, *Beaglehole* 5894 (AD, MEL); Little Mole Creek, 3.iv.1988, *Bates s.n.* (AD); Bluff Swamp, Tantanoola, 18.i.1993, *Bates* 30964 (AD, CANB); Caroline Forest, 7.i.1994, *Bates* 35759 (AD). **VICTORIA:** Gorae West, ii.1946, *Beaglehole* (MEL); tributary of Main Creek, Highfield National Park, 23.ii.1959, *Westaway* (MEL); above Tidal River, Wilsons Promontory, 13.i.1967, *Willis* (MEL); Stony Creek mouth, 8.8 km south-west of Apollo Bay, 7.i.1974, *Beaglehole* 43955 (MEL); Lonely Arm, Lake Tyers, 11.xii.1976, *Cameron* 7637 (MEL); Georges Rest, Lower Glenelg National Park, 15.ii.1991, *Albrecht* 4724 (MEL).



Figure 4: *Lachnagrostis scabra*: subsp. *scabra*: a immature contracted inflorescence x0.3; b mature expanded inflorescence x0.3; c glumes and pedicels x5; d spikelet x20; e awned floret x20; f unawned floret x20; g anther x20; h stunted plant from Bass Strait Islands x0.3; subsp. *curviseta*: i spikelet x20; j floret front view x20; k floret side view x20 (a-b Oakden, *Formby* 56 MEL, c-g *Beaglehole* 57801 MEL, h *Whinray* 2223 MEL, i-k Type: *Beaglehole* and *Finke* 21182 MEL).

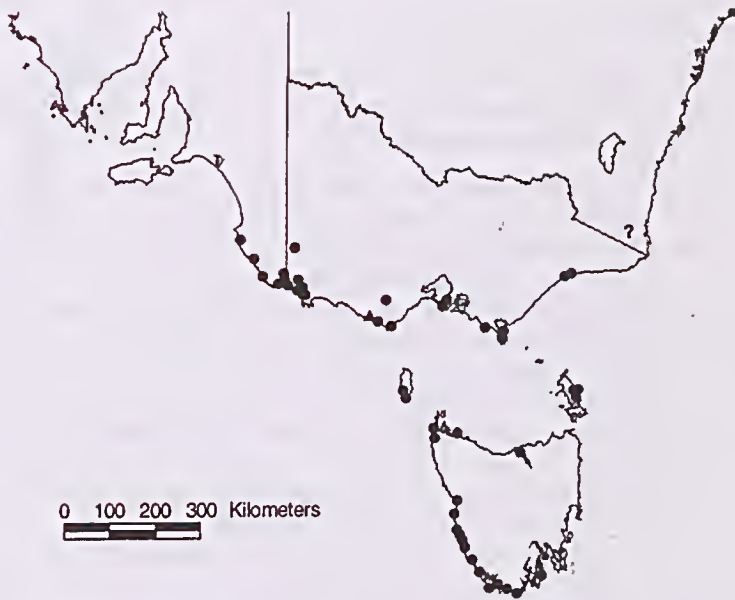


Figure 5: Distribution map of known collections of *Lachnagrostis scabra* in SE Australia (● subsp. *scabra*, ▲ subsp. *curviseta*, ? indeterminate *L. sp.* Cathcart).

1b. *Lachnagrostis scabra* subsp. *curviseta* A.J. Brown subsp. nov.

A subspecies typica arista lemmatis longiore (ad 1.4 mm longum) carvata vel geniculata differt.

Type: Sherbrooke River, Port Campbell National Park, Victoria, 6.ix.1966, *Beaglehole and Finke 21182* (holotype: MEL).

Glumes 1.7-2.3 mm long, often with a small terminal seta point (0.1-0.2 mm), scaberulous on the lateral surfaces and finely ciliate on the margins; lemmas 1.5-1.7 mm long, acute, occasionally unawned but mostly awned from the upper third of the lemma back with awns 1.0-1.4 mm long, curved to geniculate or sometimes straight, longer awns exceeding glumes by up to 0.7 mm (Fig. 4i-k).

Distribution: Known only from the Type.

Ecology: Not provided with collection but likely to be damp heath scrub vegetation.

Etymology: Named in reference to its curved awn.

2. *Lachnagrostis morrisii* A.J. Brown sp. nov.

A *L. scabra* (Beauv.) Nees ex Steud. pedicellis longioribus (saltem 4 mm), arista lemmatis semper excurrente ad nervum centralem sub 2 mm apice lemmatis inserta, lemmatibus et paleis nunquam ciliatis apicibus, glumis nunquam ciliatis marginibus differt.

Type: Russell Falls, Mt. Field National Park, Tasmania, 10.i.1948, *Curtis* (holotype: HO, isotypes: MEL, AD, AK n.v., RSA n.v.).

Agrostis rudis sensu., *Curtis*, W.M. and *Morris*, D.I., *The Student's Flora of Tasmania*, Part 4B, 1994. *Agrostis rudis* sensu., *Kirkpatrick*, J., *Alpine Tasmania*, An illustrated guide to the flora and vegetation, 1997.

Light green, loosely tufted, sometimes stoloniferous, glabrous, *annual or short-lived perennial*, to 50 cm height, culms weakly ascending to lax. *Leaf* blades rather lax, smooth to scaberulous on margins and nerves of lower surface, flat, to 15 cm long and from (1.0-)1.5-3.5(-4.5) mm wide, upper leaf sheaths scaberulous to finely papillose, ligules obtuse, soon erose, 2.5-3.0 mm long. *Inflorescence* a sparse, open panicle with spreading (lower branches reflexing with maturity), rather stiff and more or less straight branches, to 25 cm long, its base enclosed by the upper leaf sheath or exerted, branches and pedicels light green. *Spikelets* 2.0-3.0(-3.2) mm long, light green, on relatively long pedicels (shortest 5-15 mm long, longest 20-40 mm long); glumes acute and keeled, subequal (sometimes the lower 0.1-0.2 mm longer), scabrous along the keel and glabrous or sometimes scaberulous on the lateral surfaces, margins entire; lemma acute or obtuse, 1.7-2.6 mm long, minutely 4-toothed at the apex, upper nerves and teeth non-ciliate, body entirely glabrous or occasionally with a few hairs to 0.5 mm long on the callus; awn very fine and straight, 0.2-1.5 mm long, excurrent from the central nerve of the lemma (the lemma apex extending no more than 0.2 mm past the base of the awn); palea acute, 1.6-2.1 mm long, glabrous; rachilla extension plumose, (0.3-)0.5-1.5 mm long (including hairs); anthers 0.4-0.6 mm long (Fig. 6a-f). **Morris's Blown-grass.**

Notes: *Lachnagrostis morrisii* has some similarities to *L. collicola*, which also occurs within the Central Highlands of Tasmania (*Morris* 1990) but *L. morrisii* tends to have smaller spikelets, florets and awns, the glumes lack setae points and are less scabrid (particularly on the lateral surfaces). Panicles of *L. morrisii* are normally larger with more numerous spikelets and lack the purplish colouration of *L. collicola*.

Distribution: Endemic to the highlands of Tasmania, particularly the Central Highlands, mainly at altitudes of 600-1200 m but occasionally down to 200 m (Fig. 7).

Ecology: Growing in damp ground, including seepage slopes, cliff bases and stream banks; generally in shaded parts of forests; often on limestone or dolomite.

Etymology: The taxon is named in honour of the late Dr Dennis Morris of the Tasmanian Herbarium, a true gentleman and scholar, who tirelessly worked over many years, drawing attention to the unique flora of Tasmania.

Selected Specimens: **TASMANIA:** Tasmania, no date, *Archer* (HO); National Park, 19.i.1928, *Cleland* (AD); Longley, iii.1944, *Curtis* (HO); Tarraleah, near guesthouse, 7.ii.1945, *Curtis* (HO, AD); near Russell Falls, 16.i.1949, *Blake 18306* (HO); Lake St. Clair, 19.i.1949, *Blake 18335A* (HO); Hellyer River Gorge, 8.i.1967, *Willis s.n.* (MEL); Lake Little, 31.i.1982, *Buchanan 900* (HO); summit of Wherretts Lookout, 14.iii.1982, *Buchanan 950* (HO); Mt. Oakleigh, 26.i.1983, *Moscal 1490* (HO); Mt. Ronald Cross, 13.ii.1983, *Strappazon 1674* (HO); Rocky Hill, 15.ii.1983, *Moscal 1746* (HO); Croesus Cave State Reserve, 17.v.1983, *Moscal 2408* (HO); Devils Den, 18.iii.1984, *Moscal 7120* (HO); Florentine River, 16.iii.1985, *Moscal 10170* (HO); 3.5 km south of Jackeys Marsh, 11.ii.1986, *Moscal 12111* (HO); Weld River at Weld Arch, 17.i.1988, *Ziegeler* (HO); The Misty Voide, near Marakooa Cave, 12.i.1991, *Collier 5107* (HO); Myrtle Forest Creek, 16.ii.1992, *Buchanan 12314* (HO); Lake Lea, 28.ii.1994, *Buchanan 13581* (HO).

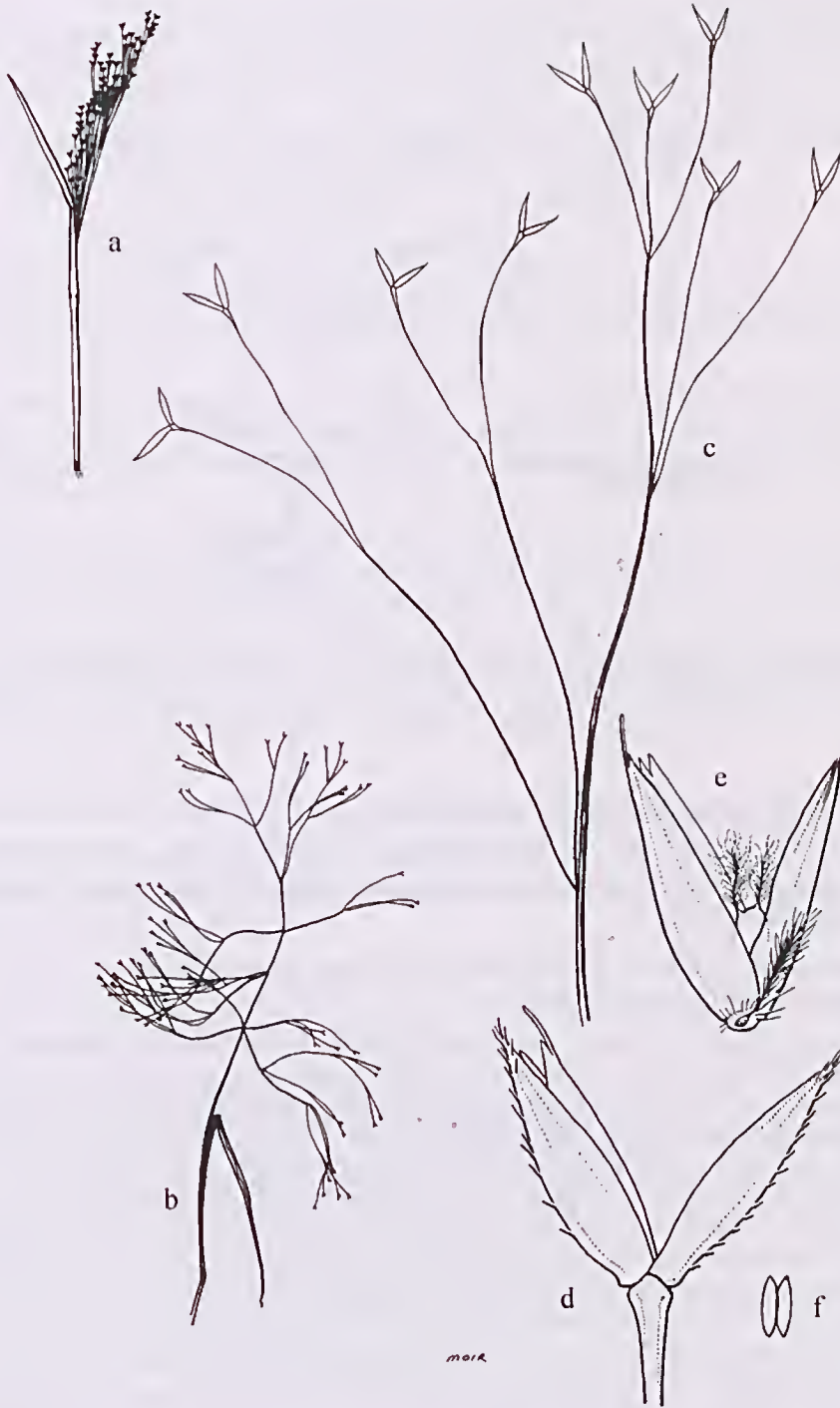


Figure 6: *Lachnagrostis morrisii*: a immature contracted inflorescence x0.3; b mature expanded inflorescence x0.3; c glumes and pedicels x3; d spikelet x20; e floret x20; f anther x20 (a Willis MEL; b-f Type: Curtis isotype MEL)

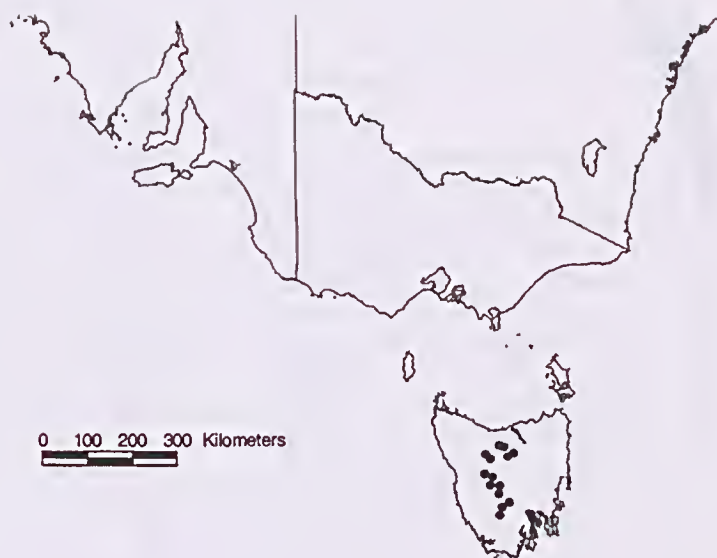


Figure 7: Distribution map of known collections of *Lachnagrostis morrisii* in SE Australia.

3. *Lachnagrostis uesomytica* A.J. Brown *sp. nov.*

A *L. scabra* (Beauv.) Nees ex Steud. pedicellis longioribus (saltem 4 mm), spiculis majoribus (saltem 2.2 mm), arista semper saltem 0.8 mm, lemmatis et paleis nunquam apicibus ciliatis differt.

Type: Lake Baghdad, Rottnest Island, Western Australia, 22.xi.1998, *Fox 005* (holotype: PERTH, isotype RTI).

Green or purplish, loosely tufted, glabrous, *annual or short-lived perennial*, 15-45 cm height, culms weakly ascending to lax. Leaf blades rather lax, smooth, flat to 10(-15) cm long and from 1.0-1.5 mm wide, ligules 4-5 mm long. *Inflorescence* a sparse, open panicle with spreading, rather stiff and more or less straight branches, to 20 cm long, its base sometimes enclosed by the upper leaf sheath but mostly exerted, branches, pedicels and glumes purplish-green to purple with age. *Spikelets* 2.0-2.8 mm long, on moderately long pedicels (shortest 4-7 mm long, longest 12-24 mm long), glumes acute and keeled, subequal or the lower slightly longer, scabrous along the keel and glabrous or very slightly scaberulous on the lateral surfaces, margins slightly ciliate; lemma acute, 1.5-1.8 mm long, minutely toothed at the apex, upper nerves and teeth non-ciliate, body glabrous or covered with scattered hairs, callus glabrous or with a few short (0.1-0.5 mm) hairs; palea acute, sometimes minutely bilobed, glabrous; rachilla extension plumose or sometimes glabrous, 0.6-1.4 mm long (including hairs); anthers 0.5-0.6 mm long. **Rottnest Island Blown-grass**

Notes: Despite the 1881 collection of this species, it appears to have been overlooked for almost 100 years. Plant species lists of the 1950's for Rottnest, Garden

and Carnac Islands failed to record any *Agrostis* (McArthur 1957). Extensive surveys of Rottnest Island from 1998-2001 listed only one collection of *Lachnagrostis/Agrostis*, that being the specimen nominated here as the type of *L. nesomytica*, then listed as *L. filiformis* (Rippey *et al.* 2003).

Etymology: After the Greek neso = island and mys = mouse or rat, in reference to the Dutch named Rottnest or Rats Nest Island.

3a. *Lachnagrostis nesomytica* subsp. *nesomytica*

Lemma glabrous with a fine and straight awn, 0.4-0.8 mm long, arising from about $\frac{3}{4}$ of the height of the lemma back; palea equal to or slightly shorter than the lemma (Fig. 8a-g).

Notes: Differs from *L. scabra* in its generally larger spikelets with longer pedicels and in its less scabrid glumes and lack of ciliate lemma apices. *Distribution*: Appears to be endemic to Rottnest Island; appearing to be restricted to the NW parts of the salt lake system (Fig. 9).

Ecology: Growing on the edges of saline lakes in peaty soil over limestone, in association with the samphire zone (e.g. *Halosarcia*, *Sarcocornia*) but in some places (e.g. Lake Baghdad) extending back into the *Gahnia trifida* community.

Other Specimens: **WESTERN AUSTRALIA**: Rottnest Island, 1881, *Walcott* (MEL); Lake Baghdad, Rottnest Island, 18.xii.2004, *Brown 1672, 1673, 1674* (MEL); Lake Negri, Rottnest Island, 18.xii.2004, *Brown 1675* (MEL); Lake Sirius, Rottnest Island, 18.xii.2004, *Brown 1676* (MEL); Lake Baghdad, Rottnest Island, 3.xi.2005, *Brown 1696, 1697* (MEL).

3b. *Lachnagrostis nesomytica* subsp. *pseudofiliformis* A. J. Brown subsp. nov.

A subspecies typical lemma pilifero, arista geniculata saltem 3 mm longa differt.

Type: Serpentine Lake, Rottnest Island, Western Australia, 3.xii.2005, *Brown 1701* (holotype: PERTH, isotype: MEL).

Lemma covered with scattered short hairs and having a strongly geniculate awn, (2.4)3.0-3.8 mm long, arising from about $\frac{1}{2}$ the height of the lemma back; palea equal to or slightly shorter than the lemma (Fig. 8j-l).

Notes: Spikelets are superficially similar to *L. filiformis* (Forst.) Trin. but the awns are finer and shorter. Paleas are subequal to lemmas, whereas those of *L. filiformis* are almost always distinctly shorter. The plants may resemble stunted forms of *L. filiformis* but the overall inflorescence appearance is stiffer and more widely divaricate, particularly when mature. The presence of this distinctive taxon so near the typical subspecies is worthy of further study at the genetic level.

Distribution: Appears to be endemic to Rottnest Island; largely occurring in the SE of the Island, though one collection has been made from Lake Baghdad (Fig. 9).

Ecology: Growing on the edges of saline swamps and lakes in samphire scrub and sometimes (e.g. Serpentine Lake) occurring at the base of the larger sedges (e.g. *Gahnia trifida*, *Ficinia nodosa*).

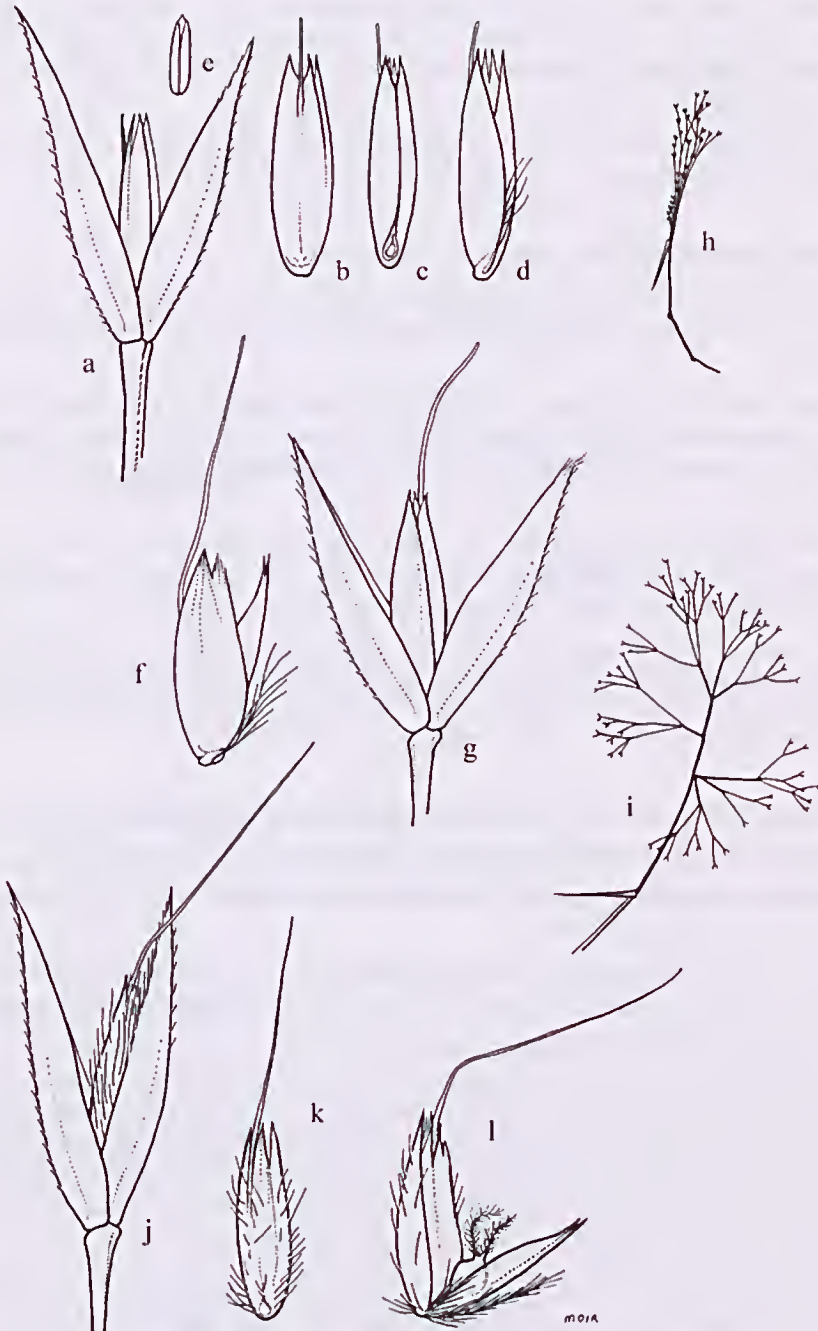


Figure 8: *Lachnagrostis nesomytica*: subsp. *nesomytica*: a spikelet x20; b floret back view x20; c floret front view x20; d floret half side view x20; e anther; subsp. *paralia*: f spikelet x20; g floret x20; subsp. *pseudofiliformis*: h immature contracted inflorescence x0.3; i mature expanded inflorescence x0.3; j spikelet x20; k floret back view x20; l floret side view x20 (a-c Walcott MEL, f-g Rippey 383 MEL, h-l Type: Brown 1701 isotype MEL).

Etymology: Subspecies named for its superficial likeness to *Lachnagrostis filiformis*.

Other Specimens: **WESTERN AUSTRALIA:** Bickley Swamp, Rottnest Island, 18.xii.2004, *Brown 1677* (MEL); Government House Lake, Rottnest Island, 18.xii.2004, *Brown 1678* (PERTH, MEL); Lake Baghdad, Rottnest Island, 3.xi.2005, *Brown 1698* (MEL); Serpentine Lake, Rottnest Island, 3.xi.2005, *Brown 1699, 1700, 1702* (MEL); Government House Lake, Rottnest Island, 3.xi.2005, *Brown 1703* (PERTH, CANB, MEL), *Brown 1704* (MEL).

3c. *Lachnagrostis nesomytica* subsp. *paralia* A.J. Brown subsp. nov.

A subspecie typica arista lemmatis semper 2 mm longa; a subspecie *pseudofiliformi* lemmate glabro et arista brevior differt.

Type: Garden Island, Western Australia, 20.x.1978, *R.J. Cranfield 43* (PERTH).

Lemma glabrous with a fine and gently curved to geniculate awn, 2.0-2.5 mm long, arising from about $\frac{2}{3}$ of the height of the lemma back; palea equal to or slightly (by 0.1-0.2 mm) longer than the lemma (Fig. 8h-i).

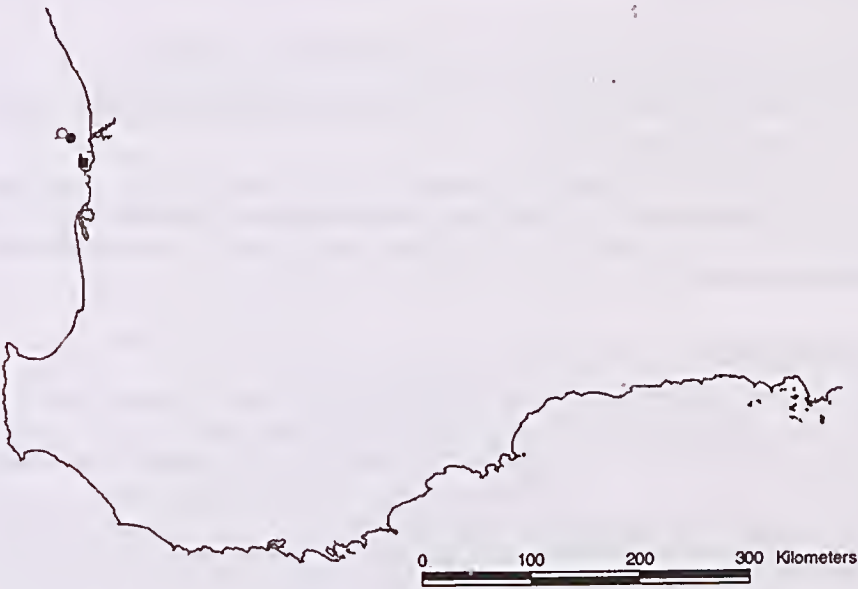


Figure 9: Distribution map of known collections of *Lachnagrostis nesomytica* in Western Australia (○ subsp. *nesomytica*, ● subsp. *pseudofiliformis*, ■ subsp. *paralia*).

Notes: Superficially similar to a delicate form of *L. filiformis* but the awns are finer (particularly in the lower part), remain pale rather than turning golden brown and tend to be attached a little higher on the lemma backs. The lemma backs are completely glabrous, unlike semi-glabrous forms of *L. filiformis* that at least have scattered hairs near the margins. Paleas are subequal to lemmas, whereas those of *L. filiformis* are almost always distinctly shorter. There are no records for *L. filiformis* on Garden Island, despite its close proximity to the mainland. The author has not had opportunity to survey the Island for *Lachnagrostis*. Because it is a Naval Support Facility, access is restricted to parts of the Island and limited to boat accessibility under curfew conditions.

Distribution: Appears to be endemic to Garden Island (Fig. 9).

Ecology: Growing on coastal dunes and swales in dry, calcareous, sandy soils in association with scattered *Callistris preissii* and *Melaleuca lanceolata*.

Etymology: The subspecific name derives from the Greek for 'Sea-side'.

Other Specimens: **WESTERN AUSTRALIA:** near Sewage Pond Road, Garden Island, 23.xi.2002, *Ripley* 383 (PERTH, MEL, GDI); Buchanan Bay, Garden Island, 11.ix.2003, *Ripley* 623 (PERTH, MEL, GDI).

4. *Lachnagrostis collicola* (D. Morris) S.W.L. Jacobs, Telopea 9:3 (2001).

Type: Tasmania, Saddle between The Hippo and Moonlight Ridge Hill 3, 10 Feb 1985, *Collier* 309 (holotype: HO).

For a description of this grass, see Brown and Walsh, 2000: as *Agrostis collicola* (D. Morris) A.J. Brown and N.G. Walsh. Note that less developed spikelets on the same panicle can be smaller (down to 2.5 mm glume length) than in the mature spikelets reported in that paper.

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